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Vol. XXV. Part 4.

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The Journal of the Department of Agriculture of Victoria, Australia.

April, 1927.

PRINCIPAL CONTENTS

Heredity and the Milking Function

Red Polls—Ideal Dual-Purpose Breed

The Government Cool Stores

Offset Harrowing with Disc Harrows

Summer Fallowing for Wheat

Pig-Feeding Experiments

Manuring of Vines

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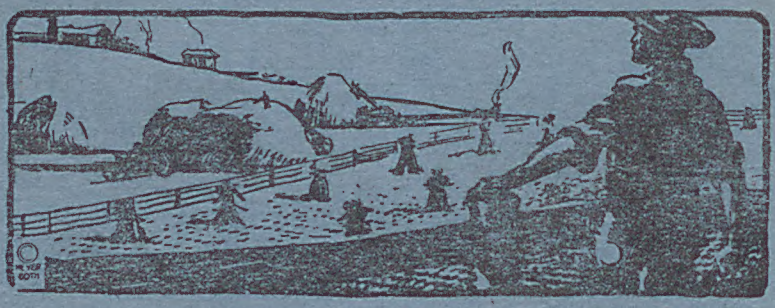

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OF

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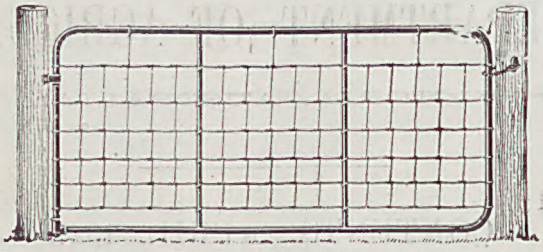

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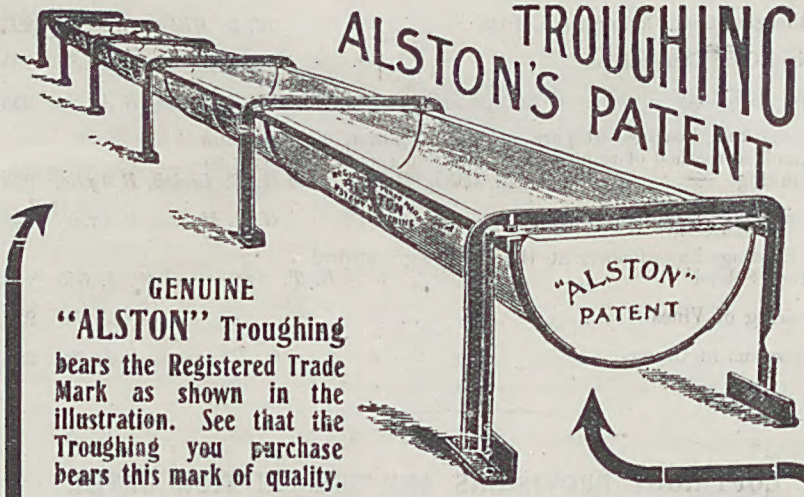

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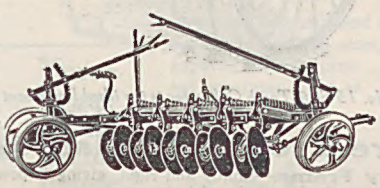

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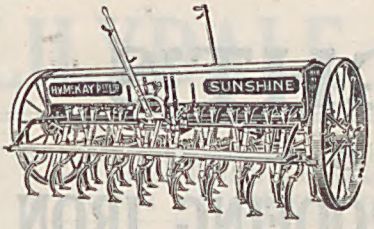

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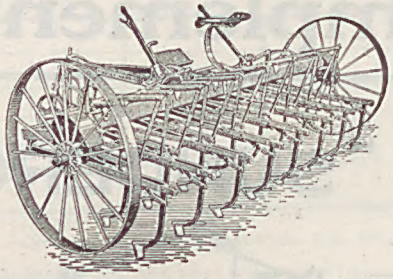

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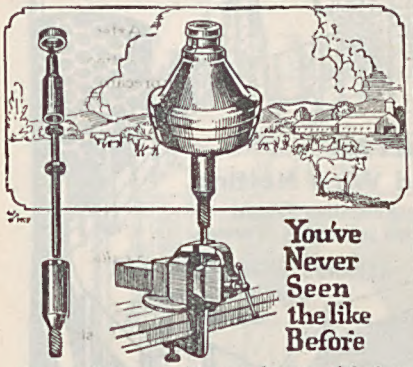

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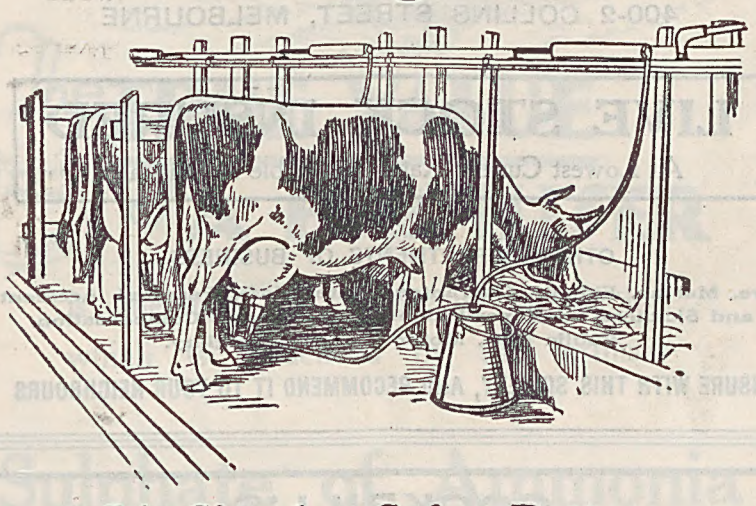

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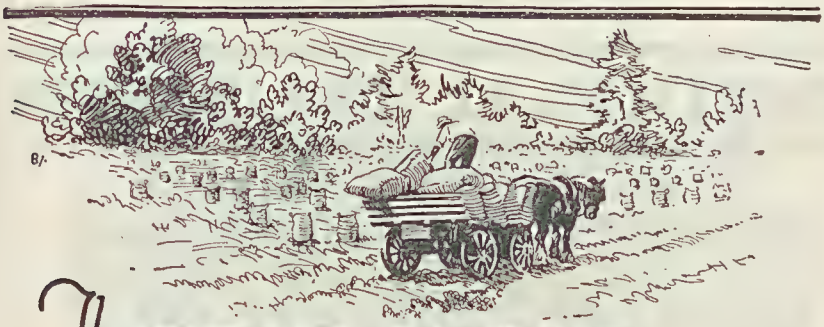

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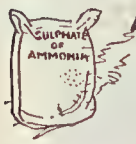

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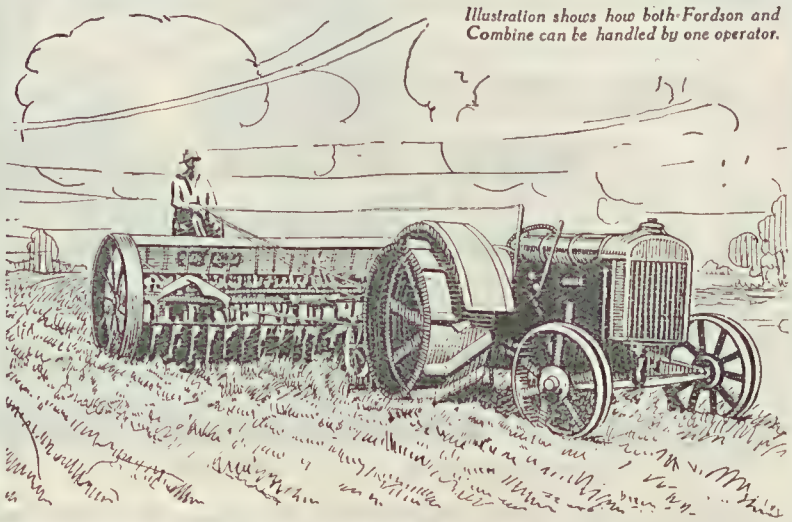

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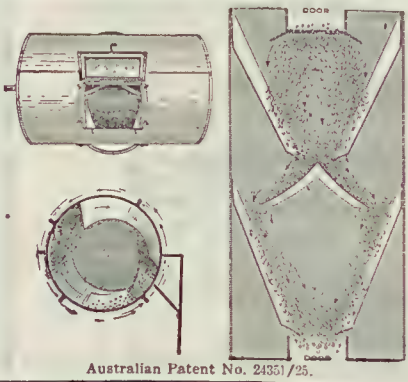

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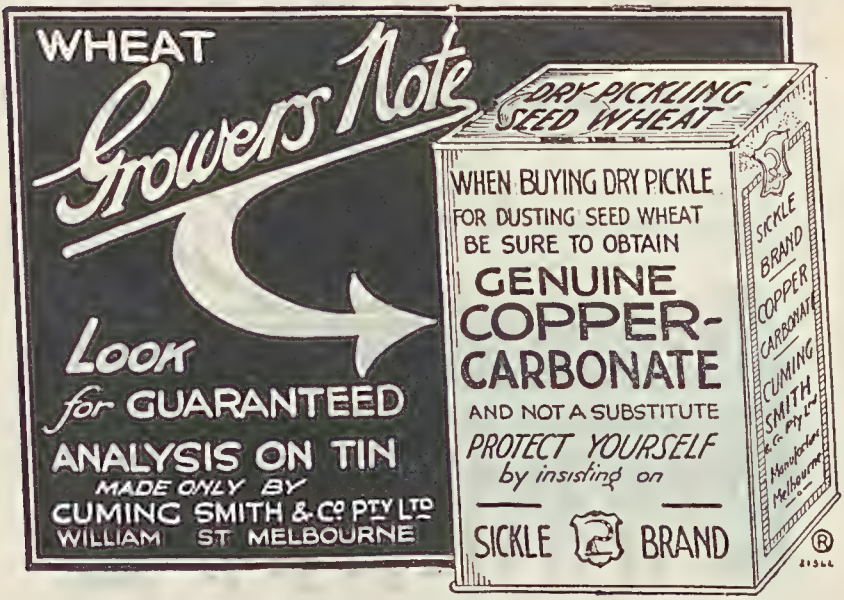

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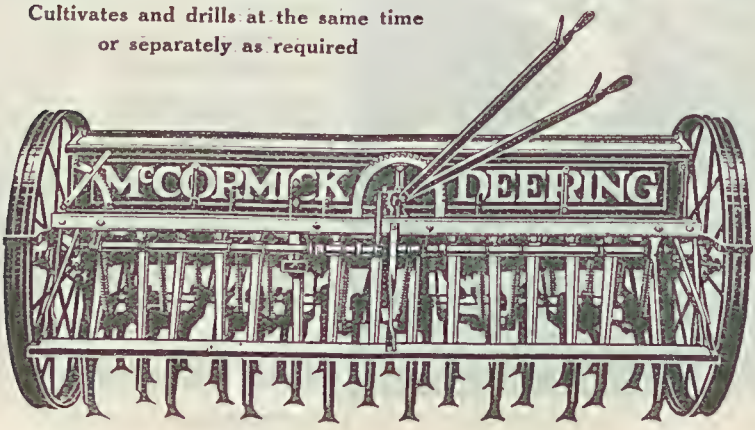

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HEREDITY AND THE MILKING FUNCTION.

Comments and Reflections suggested by the masterly exposition by Professor Agar of the scientific significance of the production records of the Victorian Government's Red Poll Herd.

(Contributed by a Grateful Breeder.)

The paper on "Heredity and the Milking Function," by Professor W. E. Agar, F.R.S., of the Melbourne University, which appeared in the January, 1926, issue of this *Journal,* is really the first scientific contribution to the study of this subject that has been made in Australia. The investigation was undertaken on the suggestion of Dr. S. S. Cameron, Director of Agriculture, who made available the records that have been kept since 1909 of the milk and butter-fat production of the Red Poll herd, which is maintained by the Victorian Government at the State Research Farm, Werribee.

So as to make accurate calculations of the influence of the mother cows in determining the inheritance of milk and butter-fat production in their daughter heifers, it was necessary to allow for the fact that a cow's production of both varies with age, the sixth being usually the year of highest production. In order, therefore, to strike an average of the milk and butter production during a cow's milking life, the figures of each year have to be corrected, and for this purpose Professor Agar worked out a set of correction factors from the records of the animals concerned. In this way the correlation or average measure of resemblance between mothers and daughters could be accurately found for total milk, total butter-fat, and butter-fat percentage or "test." It was found that the test was the most satisfactory to work with, as it is the least influenced by environment and human association. This correlation, or average measure of resemblance, was worked out in tables, by the method used with human beings in estimating the influence of fathers on their sons in the matter of height, and a co-efficient figure was arrived at. This co-efficient figure gave the measure of how much a daughter's production depends on her mother's production, and Professor Agar found, in calculating with 96 pairs of mothers and daughters, that the daughters, on an average, inherit

slightly less than one-third (.332) of their mothers' capacity on "test" character. In the same way the inheritance of total butter-fat and milk production was arrived at as far as mothers and daughters were concerned. A very valuable portion of the paper dealt with the influences of four different stud sires on the production of the herd, and, as these showed such variation, it will be interesting to try to investigate the cause from a stock-breeder's point of view.

An examination of the ancestry of the foundation Red Poll females in the "Victoria" herd reveals the names of certain sires, imported from the herds of Sir Walter Corbet, Bart., Lord Ailwyn, Mr. Harvey Mason, Lord Rothschild, Mr. T. Fulcher, and Mr. Garrett Taylor. The sires in question are "Marcus" 1924, "Laureate" 1563, "Magician" 5021, "Antic" 7799, "Honingham Alake" 9438, "Honingham Archbishop" 9702, "Acton Ajax" 9655, "Acton Dewstone" 9524, "Ruth's Boy" 4643, "Lawrence" 4994, "Magnus Boy" 9454, "Dairyman" 6109, "Barrister" 4739, "Pendant," and three other bulls imported by Mr. Chirnside. However, the major portion of the herd was descended from sires imported by Major Charley and Mr. Osborne, and from the progeny of females brought out by the breeders named from the herds of Lord Rothschild, Mr. J. J. Colman, and Mr. Garrett Taylor. From careful study of the pedigrees of these imported animals, and from the frequent recurrence of the names of certain ancient sires, one realizes that there is a more or less intimate connexion among the females that Dr. Cameron first purchased for the Victorian Government.

To mate with these foundation cows and heifers, Dr. Cameron first selected from Major Charley's herd "Tabacum" (90 A.A.), by "Acton Ajax" (imp.) 9655, ex "Janet" by "Primate" 4088, by "Laureate" (imp.) 1563. He was chosen, not on any ancestral milk records, for he had none, but on breed-type and conformation, which he successfully transmitted to his progeny, for in the words of Mr. E. Steer, late herdsman at the Werribee Research Farm, "He squared up the herd well." He produced only about half a dozen very high-class milkers, however, notably "Birdseye" (377 C), "Goldleaf" (412 C), "La Reina" (395 C), and "Sylvia" (552 D); and it is probable, judging by the results of subsequent matings, that the high milking capacity in these animals was inherited from their dams. This conclusion is supported by Professor Agar's investigation, which shows that "Tabacum" generally lowered both milk and butter-fat production in his daughters below that of their dams, but the milk much more than the butter-fat, so that at the same time he raised the test.

When Dr. Cameron came to the definite decision of developing the "Victoria" herd in the direction of dairying, he quickly culled from the herd all the "Tabacum" females except those mentioned, and he deliberately selected from Major Charley's herd "Nicotine" (69 A.A.), by "Acton Dewstone" (imp.) 9524, ex "Chessie," by "Magician" (imp.) 5021, because he was the best yearling available by "Acton Dewstone," whose greatgranddam, "Hannah" 13591, made the blood desirable. "Hannah" was bred by Mr. Garrett Taylor, and her milk yield had averaged 8,703 lb. for four years—1903-1906—and she was regarded as a great milker in her day. On the side of "Nicotine's" dam there were no milk records available. However, "Magician," the

maternal grandsire of "Nicotine," was champion of England in 1899, and, further, the name of his sire, "Majiolini" 3600, champion of England in 1896 and 1897, figures in the pedigrees of many deep milkers at Home. "Majiolini" was the sire of "Davyson 265th" 9330, champion of England in 1908, and the latter was grandsire of "Acton Crowfoot" 9987. A further point of interest is the fact that the paternal grandsire of both "Tabacum" and "Nicotine" was "Albert" 7789, who was also champion of England in 1903 and 1904, and he sired, among others, "Acton Fillpail" 20180, whose milk yield averaged 10,293 lb. for three years.

The result of introducing "Nicotine" into the herd proved the wisdom of Dr. Cameron's choice, for "Nicotine" raised both milk and butter-fat yields throughout his progeny, and left the butter-fat test but little altered. "Nicotine" also achieved the feat of siring in one season fourteen consecutive heifers, all of whom passed the Government Standard Herd Test. Among his progeny may be noted—

"Anglia" (516 D), who gave on her first calf 8,257 lb. milk, average test 4.01, and 331 lb. butterfat in 352 days.

"Scotia" (525 D), a sister of "Anglia," who in seven consecutive 273-day periods averaged 7,326 lb. milk, average test 3.98, and 296 lb. butter-fat. Her daughter, "Victoria Highland Fling" (915 C), in the mature-cow class, in 273 days, yielded 12,645 lb. milk, 4.04 average test, and 511.06 lb. butter-fat, and gave 30 lb. of milk on the last day of the test.

"Cutty" (490 D), who in eight full lactations averaged 9,446 lb. milk, average test 4.53, and 425 lb. butter-fat, and in four seasons yielded an average of 10,775 lb. milk and 476 lb. butter-fat. On her third calf she gave 11,278 lb. milk, containing 532 lb. butter-fat. Her daughter, "Cutty Sark," averaged on her first three lactations 9,142 lb. milk, 390 lb. butter-fat, average test 4.27, in 273 days, and on her fourth calf, while making five trips in the Better Farming Train, yielded 8,681 lb. milk, 375.71 lb. butter-fat, average test 4.32 Another daughter, "Victoria Cutty Sulu" (1284 C) yielded on her first calf, as a junior two-year old, 7,132 lb. milk, 319.19 lb. butter-fat, average test 4.48 in 273 days.

"Iris" (393 C), who in four full lactations averaged 7,783 lb. milk, average test 4.49, and 350 lb. butter-fat.

"Latakia" (396 D), who gave 504 lb. of butter fat in the 273 days' herd test, with an average butter-fat test in five lactations of 4.65 and 434 lb. butter-fat.

"Queen Elizabeth" (400 C), another deep milker, who in 273 days gave 11,196 lb. milk on her fourth calf, average test 4.17, and 467 lb. butter-fat.

Perhaps "Nicotine" did some of his best work on daughters of his first cousin, "Tabacum," three daughters out of "Birdseye" being specially famous:—

"Avesia" (287 B), who in seven full lactations averaged 8,976 lb. milk, average test 4.28, and 384 lb. butter-fat, and in three alternate seasons gave an average of 10,369 lb. milk and 446 lb. butter-fat.

"Nictitana" (311 B), who gave an average of 501 lb. butter-fat three years running. Her average butter-fat test in six full lactations was 5.02.

"Opticia" (335 B), who gave on her first calf 9,251 lb. milk, average test 4.42, and 410 lb. butter-fat. Then she went to New Zealand, where she made a great name for herself in the Weraroa Government herd.

"Briar" (379 C), who in seven full lactations averaged 8,045 lb. of milk, average test 4.45, and 358 lb. butter-fat.

"Goldlace" (299 B), who in four full lactations averaged 8,410 lb. milk, average test 4.43, and 373 lb. butter-fat.

"Samotina" (317 B), who in three full lactations averaged 8,508 lb. milk, average test 4.55, and 387 lb. butter-fat.

"Tabeltina" (347 B) on her first calf gave 8,589 lb. milk, average test 4.10, and 353 lb. butter-fat.

While "Nicotine" was fulfilling his career of usefulness, but before he had proved his worth, it was decided, in 1914, to import from the Old Country two Red Poll bulls of the best milking strain available, and a very modest sum was voted for that purpose. Dr. W. A. N. Robertson, now Chief Commonwealth Veterinary Adviser, went to England with instructions from Dr. Cameron to confine the choice of the bulls to families with authenticated milk records. He visited the leading herds and attended many shows, and as the result of his search he selected "Belligerent" 11096, bred by Mr. C. F. Newton, of Saham Toney, Norfolk, and "Longford Major" 10445, bred by Lord Radnor, of Longford Castle, Wiltshire. At the same time two heifers, by "Lionel" 9711, named "Velveteen" 22875 and "Primrose League" 22723, were purchased from the Marchioness of Graham, Easton Park, Norfolk.

"Belligerent" was sired by "Moor Blush" 10460, who was by "Meadow Moorberry" 10208, out of "Meadow Blush 3rd" 17126. His dam was "Meadow Rubicon" 23118, by "Achates" 9877 out of "Flaxmoor Ruby" 19209. "Meadow Rubicon" on her first calf gave 7,144 lb. milk, whilst "Flaxmoor Ruby" had a record of 14,533 lb. milk, with a four years' average of 12,871 lb., and when nineteen years of age she had averaged 11,500 lb. for eleven years. On the side of "Moor Blush," the sire of "Belligerent," there have been preserved milk records back to the great-great-grandsire's dam's dam, "Ripe Pear" 3100, who had a record of 10,088 lb. milk. Naturally the influence of that ancestress would be rather attenuated in "Belligerent," but we may concern ourselves with "Meadow Blush 3rd" 17126, the dam of "Moor Blush," who averaged for seven years 9,354 lb. milk.

"Longford Major" was got by "Longford Majiolini" 10054 out of "Mona" 18179, who was first at the Milking Trials, London Dairy Shows 1907 and 1909, and who had a record of 14,713 lb. milk, and a six years' average of 11,338 lb. "Mona" was by "Hooligan" 7203 out of "Minnie" 17171, and she had a record of 10,548 lb. and a four years' average of 9,155 lb. milk.

It will thus be seen that the recorded milking ancestry of these two imported bulls was beyond reproach, and, on the strength of that, if any sires should have made good in the "Victoria" herd, it should have been these two animals. However, it must be confessed that the results they brought about were rather disappointing. In other words, they do not seem to have quite "nicked" with the herd, and they rather illustrated that old maxim, that a complete change of blood is seldom a success, and may even be disastrous.

The research of Professor Agar went to show that "Belligerent" lowered both butter-fat and milk in his progeny, but the milk more than the fat, and so he raised the butter-fat test; while "Longford Major" reduced the butter-fat and raised the milk yield, thus lowering the test.

As regards breed-type and conformation, both these imported bulls were inferior to "Tabacum" and "Nicotine" in these respects, in spite of the fact that "Longford Major," rather by sheer force of size and weight (over 1 ton), was champion bull four years running at the Melbourne Royal Shows. He was somewhat slab-sided and hollow behind the shoulders, and his gaskins might have been better; still he had a good length of rump and was well coupled.

As for "Belligerent," he was reserve champion and took second prize at the Melbourne Royal Show in 1916, but otherwise he was not a show-ring success. He was more compact than "Longford Major," but was otherwise not a very striking animal. As regards temper, "Longford Major" was as docile as a poddy lamb, while "Belligerent" was at times inclined to be assertive, both with his fellow creatures and mankind. Neither "Tabacum" nor "Nicotine" gave trouble at any time.

Some valuable comparisons were made at Werribee by mating "Tabacum" and "Longford Major" with the same cows, "Vuelta" (555 D), "Virginia" (496 D), and "Pennsylvania," and in each case "Tabacum's" daughters tested higher than "Longford Major's." We have little information regarding the exact breeding of the ancestors of these three cows, seeing that they were bred at Mount Battery Station, where no records were kept, but we know that bulls from the herds of Major Charley and Mr. Osborne were used at Mount Battery, and we know how these sires were bred.

The old saying that the bull is half the herd is well known, but after reading Professor Agar's paper one is inclined to say that probably two-thirds of the herd would be nearer the mark. The question naturally arises whether it would not have been better for the "Victoria" herd, after seeing the results of using the sons of "Acton Ajax" and "Acton Dewstone," to have resumed the use of that blood from Major Charley's herd when seeking for fresh sires, or to have obtained some other related blood from the Acton Reynolds' herd in England. At the time the sires "Belligerent" and "Longford Major" were bought, "Acton Crowfoot" 9987 had begun to make his mark as an outstanding sire, and his stock were fetching high prices. In 1914, the New South Wales Government imported "Sudbourne Major" 10805, by "Acton Crowfoot," and two heifers, "Sudbourne Majorie" 23320 and "Sudbourne Dahlia" 22837, both of whom were in calf to "Acton Crowfoot," but the money expended for these animals was far in excess of what Dr. Robertson had at his command. Under the circumstances, the Victorian Government secured quite good bargains with the money it provided. As time goes on we shall get an answer to the query raised above when the younger generation of stud sires—"Vice Regal" (95 AA), by "Nicotine" ex "Velveteen" (imp.); "Victoria Volcano" (322 A), by "Nicotine," ex "Tonga" (253 A), by "Honingham Archbishop" (imp.); and "Victoria Bit o'Bacca" (510 A), by "Nicotine," ex "Nictitana" (311 B), by "Nicotine"—get their heifers fully into

the herd test at Werribee. So far, "Vice Regal" is doing very well, but one always has to bear in mind that in time too much in-breeding with "Nicotine's" blood may be followed by sterility in some of the stock. However, there has been no sign of this as yet, although, in his desire to accentuate the producing capacity of "Nicotine" blood, Dr. Cameron has not scrupled to push in-breeding to this sire further than most breeders consider a safe limit; for instance, "Bit o'Bacca," sired by "Nicotine" ex a daughter of "Nicotine," is being used on other daughters of "Nicotine."

Some time ago, Professor P. H. Grout, of Texas Agricultural College, U.S.A., and formerly Director of the well known Du Luth Red Poll herd, laid stress on the importance of the ancestral Red Poll bull "Norfolk Duke" 127 in any pedigree where the transmission of the milking function was looked for, especially when "Norfolk Duke" 127 was mated with the daughter of "Tenant Farmer" 213. He quoted the case of "Proctor Knott," the sire of the famous "Jean Du Luth Beauty," the star Red Poll cow, who in her day beat the butter-fat production of the Australian Red Poll cow "Muria" by a few pounds. The sire of "Proctor Knott" was "Corporal" 4313, who was imported by Mr. J. W. Martin, one of the pioneer breeders of the United States of America. In the pedigree of "Proctor Knott" the name of "Norfolk Duke" 127 appears over 250 times. As regards "Norfolk Duke" himself, in the early days of Red Poll history he was got as the result of mating a bull of the Pond tribe with a cow of the Powell tribe, and from his frequent recurrence in Red Poll pedigrees he must have been considered a bull of outstanding quality in his day. "Tenant Farmer" 213 was got by a bull of the Powell tribe out of a cow sired by a bull of the Pond tribe.

In order to work on the lines of Professor Grout's idea, Mr. Louis Monod, the Secretary of the Red Poll Cattle Breeders' Association of Australasia, made a careful study of the ancestry of certain bulls imported to, or bred in Australia by tracing back the pedigrees as far as the herd books would allow. It was seen that it was not enough to merely count the number of times that "Norfolk Duke" 127 was mentioned in a particular pedigree but rigorous calculation had to be made of the actual amount of "Norfolk Duke's" blood in each generation. In the list of sires whose pedigrees have been so treated, the name of "Acton Crowfoot" has been included, because to-day his blood is most sought after where deep milking is wanted. The following list of bulls and the figures attached are, therefore, interesting:—

Name of Bull.	Calved.	No. of Times "Norfolk Duke" appears in Pedigree.	Approximate Percentage of "Norfolk Dukes" Blood.
			%
Belligerent (imp.) 11096	1914	277	19
Longford Major (imp.) 10445	1912	252	17
Magician (imp.) 5021	1896	13	17
Laureate (imp.) 1563	1888	5	19
Nicotine (69 A.A.)	1910	110	21
Tabacum (90 A.A.)	1908	62	25
Acton Crowfoot, 9987 (Eng.)	1909	98	20

Both "Belligerent" and "Longford Major" showed over 250 recurrences of the name of "Norfolk Duke," but neither of them has sired a "Jean Du Luth Beauty," and "Tabacum," with a higher percentage of "Norfolk Duke's" blood, was far from being the equal of "Nicotine."

The act of bringing a fresh sire into a herd has been the rock upon which many a breeder has come to disaster. This is where the instinct of the skilled breeder comes in. After years of experience and not a few mistakes, which by the way are not often talked about (worse luck), a breeder gets to know what blood will "nick" with his herd. But what constitutes the "nicking" quality in a bull? When we can answer that question, the main difficulty in stockbreeding will have been solved. Perhaps another Bruce Lowe will arise, who will work out a new figure system for cattle, as has been done for racehorses; but, at present, though we can estimate some of the value of a bull by his ancestry, yet it is really by his progeny that he should be mainly judged. However, for all breeders, even for the most cock-sure young beginner, it is wisest to try a new bull on a few cows only, and note the result. If he proves successful, then his services may be extended through the herd. At the same time, the matter of breed-type, conformation, and constitution cannot be overlooked. When in doubt, a breeder will not go far wrong if he follows the rule to keep the blood in the same family.

The milk records of the "Victoria" Red Poll herd have revealed some important facts. Among them they show that the milking function is probably a Mendelian character, for there are some cows in whose progeny that function is obviously dominant, while in others it is recessive; but so far it does not seem possible to foretell which is which, and a law of heredity cannot be very strictly demonstrated. In most herds, only the records of the good cows are published, while the poor milkers are sold at auction as "springers" for some other fellow to try his hand on.

However, in the "Victoria" herd, since its inception, the records of all have been available. The writer has perused genealogy tables, drawn up by Mr. Monod, of the "Virginia," "Muria," "Connecticut," and "Bullion" families, and has found them most instructive.* It is only by means of tables such as these, that one can take in at a glance the milking qualities of a particular family. Both good and bad milkers come before the eye, and one can grasp the influence of the different sires in a way that is a help in further breeding operations. One finds that, though a heifer descended from a good milker may be a disappointment to the breeder, yet she, in her turn, may produce a good yielding heifer, as witness the case of "Victoria Balloon," granddaughter of "Silken Bond." Are we, therefore, to consign to the oblivion of the saleyard or abattoir such a cow because the milking function with her has been in abeyance, only to re-appear with greater force in her daughter or granddaughter? It savours of condemnation without a fair trial, and we know that the inheritance of gout in the human race often skips a generation. Of course, "passenger" cows

* Unfortunately space will not permit of the publication here of these tables

in a commercial herd have to be got rid of, but a too rigid adherence to the rule of parting with everything that does not fulfil herd-test conditions may be the means of stamping out a valuable strain from a herd.

Of the four cows mentioned above, whose genealogy has been tabulated, "Muria" naturally arouses most interest owing to her being such a phenomenal performer, yet her progeny fulfilled expectations only along one line—"Corona" and "Coronation." It has to be remembered that "Corona" had only three-quarters, and with these she made a good show. "Muria's" earlier heifers and their progeny also were "dud" milkers, and had she died before dropping "Corona" in her eleventh year, she would have been regarded as a "freak" milker, without hereditary causation or influence. "Corona's" performances as milker and breeder would indicate that "Muria" was "hybrid" to the milking character.

The "Virginia" family is the one that produced the most efficient performers, and, so far, "Virginia's" granddaughter "Opticia" has outstripped the rest, for at eight years old she gave in the season 14,569 lb. milk and 605 lb. butter-fat whilst in the previous lactation she had given 10,606 lb. of milk with 468 lb. of butter-fat, and she is quite the best milker in the Government herd at Weraroa, New Zealand. Among "Virginia's" five daughters there have appeared the inevitable recessives, "Three Castles" being a very ordinary cow, and "Virgilia," her last daughter, dropped when her dam was fifteen years old, is the family disgrace. If "Virginia" had died before producing "Virgilia," she would have gone down in Red Poll history as a cow whose family progeny and descendants had never failed as producers.

The same remarks apply to the "Bullion" family, for here the "Goldleaf" branch did well at the pail, but "Gilt" had only one redeeming feature—she was an ideal butcher's cow, and fetched £29 when fat.

In the case of "Connecticut" her daughters "Cutty" and "Pipio" have done well, and have founded famous producing families; but the "Crimson Thread" strain has been rather a failure.

As these four cows, themselves star producers, have not always transmitted good milk production to their female offspring, what has been the case with the bulls out of these cows? We have, so far, been able to obtain information regarding only one of the sons of "Muria," viz., "Force Majeure," who was used at Weraroa, New Zealand. "Force Majeure" has sired five daughters who have yielded from 300 to 382 lb. of butter-fat as junior two-year olds. He also sired "Dominion Tabletop," who gave 9,185 lb. of milk and 410 lb. of butter-fat in 333 days.

Of the "Virginia" family we have records of three sons and one grandson of "Birdseye" whose daughters have been tested. The first of these sons, "Flight Commander," by "Belligerent" (imp.) sired "Victoria Highland Fling," who has produced up to 511 lb. of butter-fat in 273 days, compared with 319 lb., the best record of her dam "Scotia." He also sired that fine heifer "Corriedale Gala Princess," which in the hands of a youthful member of the Geelong Calf Club has averaged just on 312 lb. butter-fat in her first three lactations of 273 days. The

second son, "High Flyer," by "Nicotine" has singularly enough had an adverse influence on production, for, compared with that of their dams, he depressed the production of three out of four daughters of whom we have records. The third son, "Wing Major," by "Longford Major" (imp.) has only one daughter tested to date, viz., "Victoria Magnolia," and on her first calf she shows the marked improvement of 100 lb. of butter-fat on her dam's ("Mongolia's") production during her first lactation. The grandson "Aviator" sired two junior two-year olds—"Dominion Sylvania," who gave 8,133 lb. of milk and 359 lb. of butter-fat in 326 days, and "Dominion Sylphide" whose yield was 8,651 lb. of milk and 430 lb. of butter-fat in 341 days. The other bulls descended from the four cows in question were sold for breeding purposes, and no records are available. However, we can safely infer that, as in the case of the females we have tabled, some of these bulls would transmit the milking function to their heifers, while others would be indifferent in this respect.

This raises the question whether it is advisable to insist on the idea that only bulls from tested cows should be used in a herd. Some extremists would legislate to castrate all bulls out of cows that fail to reach a standard test. Should that idea ever become the law of the land, some disappointment will be caused by a few of the bulls that have remained entire, at all events, until breeding under guidance of the test has become so general as to have resulted in such guidance being more reliable than it is at present.

Take the case of "Acton Dewstone" (imp.), the sire of "Nicotine." His dam "Acton Dewdrop" 18977 was never tested, so we have been informed by Mr. Reginald Astley, who controlled the Acton Reynolds herd of Red Polls for many years; in fact, her only record was winning third prizes at the Bath and West of England and the Suffolk Shows.

To raise the milk production of a herd, one cannot get on without the Babcock tester; but, in addition, the sheet anchor of the breeder for a long time to come will remain "careful selection and rigorous culling," not forgetting the old saw that "three-fourths of the breeding goes down the throat."

Professor Agar says that in this way the individuals of a herd will get more uniform, until finally the breed is fixed at a high level of performance. Of course, the hope is that by continued testing, culling, and selection, the level of a herd will be raised so high that a heifer or bull from such a herd will practically always show the milking function to be a dominant character. A breeder can then, with a *dual purpose* breed, like the Red Poll, improve the carcase from a beef point of view, and at the same time select and cull so as to secure an evenly balanced milk vessel. When all this has been done, the breeder must endeavour to keep his stock at a uniform high level of excellence, and ever remember that everything can be undone by introducing into his herd one bull that does not "nick."

A visit to the Red Poll herd at Werribee will show what has been effected. The cows are big animals, of the typical *dual-purpose* type, with uniformly well-shaped udders. There are a few cases of cloudy and spotted muzzles, but this fault is being steadily bred out. Four hundred pounds of butter-fat and a well-shaped udder will redeem the

fault of a few pigment spots on the nose. Critics have drawn attention to some animals whose hook bones are rather prominent, and regard this as implying an introduction of Shorthorn blood. In the standard description of the Red Poll in England, in America, and Australia, breadth across the hips is essential, and the commonly accepted good points of a superior animal apply to Red Polls as well as Shorthorns.

The question whether a trace of blood of another breed was introduced into the Red Poll, say, eight generations back in the breed's history, is really of small practical importance, and does not affect the utility of the Red Poll at the present time. Many of the early imported Red Polls had only short pedigrees; "Laureate" 1563 only could trace back to his fourth dam, and "Marcus" 1924 to his fifth dam, and the same applies to the females imported about 1890. We know little or nothing of the origin of the old tribes, like those of Pond and Powell, but we do know that Thomas William Coke, 1st Earl of Leicester (1754-1844), of Holkham, Norfolk, introduced the red whole coloured horned Devon cattle into Norfolk in 1791, and these were mated with the old red horned Norfolk cattle, and these, in turn, were crossed with the hornless dun Suffolk cattle to produce the modern Red Poll. This merger is regarded as having been completed by the year 1846, when the Red Poll was finally established. These Devons have not prejudicially affected the breed, and the possible Shorthorn taint in the "Victoria" herd of Red Polls may be treated as negligible.

As regards star milkers, if one turns up in a herd, the breeder can only accept her and be thankful. An experienced Jersey breeder in the Old Country once remarked that the number of "top notchers" in his herd, after a lifetime of selection, could be counted on the fingers of one hand. The Friesian world-beater "Tilly Alcartra" (U.S.A.) and the equally famous milking Shorthorn record-breaker "Melba 15th" (Australia) have not thrown progeny to outstrip the parents. One, therefore, cannot help feeling that such a temperamental act as very high milk production in a cow is not unlike genius in mankind which notoriously is not transmissible from parent to children; in fact the utmost we can say regarding the inheritance of human genius is that no very clever man ever had a fool for a mother.

ADDENDUM.

Since writing the above, the report of the Victorian Government Standard Herd Test for 1925-26 has been published, and in it the performances of the Red Polls of the "Victoria" herd, maintained at the State Research Farm, Werribee, are of special interest. A visit to the Research Farm is valuable, for one can note there the good dual purpose type of the Red Polls and their well-shaped milk vessels. The development of this type along with the excellent performance of the herd as a whole raises the question whether the Red Poll breeders in Australia are quite on the right track so far as their own breeding operations are concerned.

In the Herd Test report in question it will be seen that 36 Red Poll females in the "Victoria" herd were entered for the 273 days' test according to the following list, and of these, 28 were certificated:—

Name of Cow and Herd Book No.	Age Standard.	Date of Calving.	Milk last day of Test.	Milk.	Average Test.	Butter Fat.	Standard Required
Victoria Euphrates (716 A)	Sr. 2 yrs.	27.1.25	191/2	5,974	4·13	246·74	225
Victoria Calumet (790 B)	Sr. 2 yrs.	1.2.25	31	6,570	4.73	310.91	225
Victoria Virgilia (863 C)..	Sr. 3 yrs.	8.2.25	161/2	5,811	4·86	282·51	275
Victoria Florin (717 A) ..	Sr. 2 yrs.	19.2.25	20	6,184	4·13	255·50	225
Victoria La Regal (718 A)	Sr. 2 yrs.	27.2.25	30	8,805	3·63	319·87	225
Victoria Rose Major (5 AA)	Jr. 4 yrs.	3.3.25	25	8,274	3·98	329·56	300
Briar (379 C)	Mature	7.3.25	141/2	7,565	4·42	334·40	350
Nictitana (311 B) ..	Mature	3·4·25	331/2	11,613	4·53	525·77	350
Ontario (399 C) ..	Mature	4.4.25	221/2	7,416	3·76	278·63	350
Victoria Bellata (786 B)..	Sr. 3 yrs.	18.4.25	211/2	7,824	4·22	329·00	275
Victoria Balloon (1144 A)	Sr. 2 yrs.	24·5·25	..	5,272	4·21	221·93	225
Victoria Kia (1245 B) ..	Sr. 2 yrs.	4.6.25	22	7,141	4.33	309·45	225
Victoria Longbird (1158 A)	Sr. 2 yrs.	5.6.25	15	6,361	4·81	306·01	225
Victoria Thorn (1248 B)..	Jr. 2 yrs.	6.6.25	..	5,089	3.82	194.32	200
Victoria Cutaway (1241 B)	Jr. 2 yrs.	29.8.25	16	5,493	4·52	248·25	200
Victoria Cutty Sulu (1284 C)	Jr. 2 yrs.	9.9.25	171/2	7,132	4·48	319·19	200
Ornitha (313 B) ..	Mature	11.9.25	14	7,360	4.87	358.63	350
Victoria Sweet Briar (1247 B)	Jr. 2 yrs.	11.9.25	16	5,850	4·65	271·96	200
Victoria Velvet Crown (967 AA)	Jr. 2 yrs.	11·9·25	17	6,141	5·01	307 94	200
Pico (250 A)	Mature	27.9.24	11	7,932	4·18	331.27	350
Victoria Ghenta (793 B)..	Jr. 3 yrs.	1.10.24	14	4,753	4.35	206.83	250
Victoria Bright Eye (788 B)	Sr. 2 yrs.	7.10.24	171/2	6,772	5·18	350·53	225
Victoria Bellbird (714 A)	Sr. 2 yrs.	14.10.24	13	6,427	5·25	337 43	225
Victoria Stripe (723 A) ..	Sr. 2 yrs.	17.10.24	21	7,242	4 07	294 80	225
Victoria Rose Regal (560 AA)	Jr. 3 yrs.	23.10.24	4	4,249	4·25	180 55	250
Victoria Maple Leaf (719 A)	Sr. 3 yrs.	30.10.24	13	7,719	4·16	321 04	275
Victoria Coronation (792 B)	Sr. 3 yrs.	31.10.24	10	6,636	4·45	295 16	275
Victoria Bellona (787 B)	Jr. 3 yrs.	7.11.24	131/2	5,662	5.12	290 02	250
Victoria Smyrna (1161 A)	Jr. 2 yrs.	14.11.24	131/2	5,203	4·43	230 74	200
Victoria Blue Ribbon (1149 A)	Jr. 2 yrs.	16.11.24	141/2	5,070	4.89	248·10	200
Victoria Veloutine (561 AA)	Sr. 3 yrs.	16.11.24	25	9,079	3.64	330 41	275
Victoria Magnolia (1246 B)	Jr. 2 yrs.	23.11.24	17	7,518	4·39	330·17	200
Victoria Velvicene (968 AA)	Jr. 2 yrs.	29.11.24	171/2	5,692	4·74	270·02	200
Broom (240 A).. ..	Sr. 4 yrs.	19.1.25	4	7,683	4·02	309 00	325
Victoria Distant View (1152 A)	Jr. 2 yrs.	25.1.25	241/2	7,027	4·59	322·46	200
Victoria Silver Slipper (965 AA)	Jr. 2 yrs.	26.1.25	141/2	6,675	4·23	282·35	200

These 36 cows and heifers belonged to the following age classes:—

Mature cows, 5 years old and over at the time of calving .	5
Senior 4-year olds, between 4½ and 5 years at time of calving	1
Junior 4-year olds, between 4 and 4½ years at time of calving	1
Senior 3-year olds, between 3½ and 4 years at time of calving	5
Junior 3-year olds, between 3 and 3½ years at time of calving	3
Senior 2-year olds, between 2½ and 3 years at time of calving	10
Junior 2-year olds, under 2½ years at time of calving ..	11
Total	36

It will be seen that these cattle were mostly young animals, 21 being under three years old at the time of calving. This fact makes the performances all the more creditable, because it is well known that a cow does not, as a rule, reach her highest production until she is six years old.

The standard required from the junior two-year-olds is 200 lb. butter fat, and all passed but one, "Victoria Thorn" (1,243 B), who, however, yielded 194 lb. butter fat. The standard from the senior two-year-olds is 225 lb. butter fat, and here again only one failed to yield the required amount, "Victoria Balloon" (1144 A), and she gave 221.9 lb., so that neither of these two heifers was very far behind the test required. Among the junior two-year-olds, five heifers gave over 300 lb. butter fat, and among the senior two-year-olds, five heifers gave over 300 lb. It is the behaviour of these two-year-old heifers that redounds to the credit of the "Victoria" herd, and shows what can be done by careful selection and culling on test in progressively improving the performance of the herd. When one compares this performance with those of other herds entered for this test, these facts should be emphasized, for, to take the case of the champion herd, Messrs Flack and Gamble's Friesian No. 1 herd, numbering twelve cows, eight of the latter were five years old and over.

As regards the registration classes of these 36 animals, six were in the AA class. Thirteen were in the A class, showing at least six top crosses with registered Red Poll sires. Thirteen were in the B class, showing five top crosses with Red Poll sires, and four were in the C class, showing four top crosses with Red Poll sires.

Of the six AA class females, all passed the test but one, "Victoria Rose Regal" (560 AA), a junior three-year-old, who yielded 180.5 lb. butter fat when the required standard was 250 lb., and she had no previous record to her credit. The greatest yield in the AA class was by "Victoria Veloutine" (561 AA), a senior three-year-old, who yielded 330 lb. butter fat, with a required standard of 275 lb., but this was really eclipsed by "Victoria Velvet Crown" (967 AA), a junior two-year-old, who gave 307.9 lb. butter fat, nearly 108 lb. over the required 200 lb. standard.

Among the thirteen A class females, three failed to pass the test; but of these "Pico" (250 A), a mature cow, had three splendid previous records behind her. The junior two-year-old, "Victoria Distant View" (1152 A) exceeded the 200 lb. standard by 122.4 lb.

With the thirteen B class females, two failed to pass the test—"Victoria Thorn," previously mentioned, and "Victoria Ghenta" (793 B) a junior three-year old, who only gave 206.8 lb. butter fat out of a standard of 250 lb.; but she gave 321 lb. on her first calf. The star cow, "Nictitana" (311 B), a mature cow, yielded 525.7 lb. butter fat, and she had seven magnificent previous records to her credit.

Among the four C class females, two failed to pass the test—"Briar" (379 C) and "Ontario" (399 C), both mature cows, with seven and eight good previous records respectively. Of the others, "Victoria Virgilia" (863 C), a senior three-year-old, improved her

first record, and "Victoria Cutty Sulu" (1284 C), a junior two-year-old, exceeded the 200 lb. standard by 119 lb. butter fat.

The breeding of these 36 Red Poll females is of special interest, and this will probably be even more so in the future, because much valuable information will have been accrued by then regarding the lines to follow in the future choice of herd sires, always a knotty problem for the farmer and one which is overlaid with uncertainty. The table as follows is explanatory to some extent:—

Name.	Sire.	Dam.	Sire of Dam.	Family of.
Mature Cows—				
Pico	Belligerent (imp.)	Azora	Nicotine	Atlanta
Briar	Nicotine	Pipio (500 D)	Tabacum	Connecticut
Nictitana	Nicotine	Birdseye (377 C)	Tabacum	Virginia
Ontario	Acton Dewstone (imp.)	Canada (545 D)	Dictator	Americana
Ornitha	Nicotine	Birdseye (377 C)	Tabacum	Virginia
Senior 4 Year Old—				
Broom	Nicotine	Bramble (291 B)	Belligerent (imp.)	Connecticut
Junior 4 Year Old—				
Victoria Rose Major	Longford Major (imp.)	Victoria Red Rose (3AA)	Red David 10069	Primrose League (imp.)
Senior 3 Year Olds—				
Victoria Maple Leaf	Nicotine	Toronto (326 B)	Belligerent (imp.)	Americana
Victoria Coronation	Viceregal	Corona (382 C)	Nicotine	Muria
Victoria Veloutine	Nicotine	Victoria Velour (6 AA)	Longford Major (imp.)	Velveteen (imp.)
Victoria Virgilia	Viceregal	Virginia (496 C)	Battery (189 D)	Virginia
Victoria Bellata	Belligerent (imp.)	Latakia (396 C)	Nicotine	Turka
Junior 3 Year Olds—				
Victoria Ghenta	Longford Major (imp.)	Flandrina	Nicotine	Netherlana
Victoria Rose Regal	Viceregal	Victoria Red Rose (3 AA)	Red David 10069	Primrose League (imp.)
Victoria Bellona	Belligerent (imp.)	Queen Elizabeth (400 C)	Nicotine	Virginia
Senior 2 Year Olds—				
Victoria Bright Eye	Viceregal	Birdseye (377 C)	Tabacum	Virginia
Victoria Bellbird	Belligerent (imp.)	Avesia (287 B)	Nicotine	Virginia
Victoria Stripe	Viceregal	Chevron (242 A)	Nicotine	Bullion
Victoria Euphrates	Viceregal	Tigra (324 B)	Nicotine	Persica
Victoria Calumet	Belligerent (imp.)	Hookah (392 C)	Longford Major (imp.)	Connecticut
Victoria Florin	Longford Major (imp.)	Sovereign (320 B)	Belligerent (imp.)	Bullion
Victoria La Regal	Viceregal	La Bassee (304 B)	Highflyer (133 B)	Virginia
Victoria Balloon	Viceregal	Kite (302 B)	Highflyer (133 B)	Connecticut
Victoria Kia	Viceregal	Latakia (396 C)	Nicotine	Turka
Victoria Longbird	Longford Major (imp.)	Ornitha (313 B)	Nicotine	Virginia
Junior 2 Year Olds—				
Victoria Smyrna	Viceregal	Laodicea (306 B)	Belligerent (imp.)	Turka
Victoria Blue Ribbon	Earl of Beaconsfield (35 AA)	Chevron (242 A)	Nicotine	Bullion
Victoria Magnolia	Wing Major	Mongolia (307 B)	Acton Dewstone (imp.)	Asiana
Victoria Velvicene	Viceregal	Victoria Velvine (8 AA)	Nicotine	Velveteen (imp.)
Victoria Distant View	Viceregal	Sky Vision (319 B)	Longford Major (imp.)	Virginia
Victoria Silver Slipper	Viceregal	Belmont Cinderella (559 AA)	Honingham Astrologie (imp.)	CherryBud (imp.)
Victoria Thorn	Viceregal	Briar (379 C)	Nicotine	Connecticut
Victoria Cutaway	Longford Major (imp.)	Cutty Sark (383 C)	Belligerent (imp.)	Connecticut
Victoria Cutty Sulu	Viceregal	Cutty (490 D)	Nicotine	Connecticut
Victoria Sweet Briar	Belligerent (imp.)	Briar (379 C)	Nicotine	Connecticut
Victoria Velvet Crown	Viceregal	Victoria Velvet (7 AA)	Belligerent (imp.)	Velveteen (imp.)

When the "Victoria" herd was started in 1909, Red Poll females of many different families were secured, but the number of foundation families retained in the herd has since been much reduced, owing to its being found by dint of herd testing and selection that the milk production ran in certain particular families more than in others. Of the 36 females entered in the last herd test, the Virginia family accounted for nine; the Connecticut family for eight; the Turka, Velveteen and Bullion families for three each; the Americana and Primrose League families for two each; the Persica, Netherlana, Muria, Asiana, Atlanta and Cherry Bud families for one each.

When we examine the above list we note the frequent recurrence of the name of one particular sire, "Nicotine," a son of "Acton Dewstone" (imp.), who in turn was a son of "Albert," twice champion of England. As sire to the younger females, the name of "Viceregal" recurs often, and he was a son of "Nicotine" out of "Velveteen" (imp.), who was a daughter of "Lionel" 9711. "Lionel" also sired "Primrose League" (imp.), and she was the dam of "Earl of Beaconsfield," who sired one of the young heifers, "Victoria Blue Ribbon." The other sires mentioned in the same list include "Tabacum," another grandson of "Albert, "Belligerent" (imp.), and "Longford Major" (imp.), "Highflyer" and "Wing Major," the last two belonging to the Virginia family on their dams' side.

It will be seen that milk production in the "Victoria" herd has been consistently dominant in certain families, notably those of Virginia and Connecticut. This must always be the case, and will, doubtless, continue to develop more and more as time goes on. In order to accentuate a tendency to produce milk, it is necessary to mate with close relations, and at the Werribee Research Farm, the two young bulls that are coming on are (1) "Victoria Volcano" (322 A), by "Nicotine" ex Tonga (253 A), by "Honginham Archbishop" (imp.), and (2) "Victoria Bit O' Bacca" (510 A), by "Nicotine" ex "Nictitana" (311 B), by "Nicotine." "Tonga" gave 513 lb. butter fat on her sixth calf, and she is a member of the Polynesia family, and "Nictitana" is a very deep milker of the Virginia family. It is quite possible that trouble may follow on breeding a little too closely, but what else can be done? To go off and bring in a totally fresh strain of blood, imported or otherwise, may only lead to disaster, owing to the fact that such blood may not "nick" with the members of the herd; and no stock-breeder can afford to take big risks. The "Nicotine" blood will have to be preserved in this herd at all costs, but it will be quite possible to use what is termed a "climatic outcross" and this can be got by using a bull descended from "Nicotine," two or three generations back, but bred and reared on another place. This is following the plan of the late Mr. Robert Clarke, of Bolinda Vale, with the Derrimut strain of Shorthorns. Mr. Clarke once sent a portion of the Bolinda herd to Cobram Station, Deniliquin, New South Wales, and after some years he brought back to Bolinda Vale a young Cobran-bred bull of exactly the same blood, and used him in the parent herd with the best results.

Should it be desired to replace the "Nicotine" blood with an imported sire, then it would be necessary to try to obtain a descendant of "Albert," the champion paternal grandsire of "Nicotine," and also of "Magician," the maternal grandsire of "Nicotine." "Magician" was champion of England in 1899, and he was a son of "Majiolini," champion of England in 1896 and 1897. It should be possible to obtain these strains in the Old Country, and so secure a "climatic outcross" of the same blood.

Now comes the question, whether it be absolutely necessary to secure a sire of "Nicotine's" blood in the AA registration class of the Australian Red Poll Herd Book, that is of pure descent from imported blood on both sides. Neither of two "Nicotine" bulls now in use in the "Victoria" herd is in the AA class, because the AA cows in the herd are by no means in the first flight as producers, and Dr. Cameron persists in refusing to sacrifice known producing power for a meaningless length of pedigree. "Victoria Volcano," however, has seven top crosses of pure Red Poll blood, whilst "Victoria Bit o' Bacca" has six top crosses and these should suffice, though it is quite possible they have more. When we go back to the seventh top cross, the blood of that particular ancestor is very attenuated in his last generation of descendants. When we critically examine the breeding of some of the Red Poll sires in the English Red Poll Herd Book, we find some very short pedigrees. Take the case of the famous bull, "Norfolk Duke" (127), got by a bull of the Pond tribe out of a cow of the Powell tribe, also of "Tenant Farmer" (213), who was got by a bull of the Powell tribe out of a cow by a bull of the Pond tribe. We know little more of these two sires than the fact that when "Norfolk Duke" was joined with the daughters of "Tenant Farmer," their progeny were most desirable, both as milk producers and as beef animals; or, in other words, they "nicked" well together.

When the Australian Red Poll Herd Book was started, the Red Polls of Australia had been bred in many cases in a haphazard way, and only in such early herds as Major Charley's had pedigrees been carefully recorded. It was necessary to secure some control over the breeding of the other Red Polls in the country, and this could only be done by instituting certain classes, beginning with the A class, showing at least six top crosses of Red Poll blood down to the D class with three top crosses only. As time goes on, the lower classes B, C and D will diminish in numbers and eventually die out. It is the intention of the Red Poll Cattle Breeders' Association to gradually refuse registration to bulls of the lower classes, and this has been already resolved on in the case of the C and D classes. Hence, before long the only bulls that will permit of registration will be those of the AA and A classes and the latter will contain animals with an increasing number of top crosses, so that practically they will be as good as bulls of the AA class, especially when they come from a herd where herd testing, selection, and culling have been consistently carried out.

A Red Poll of the A class, no matter how many top crosses of pure Red Poll blood have been used, can never hope to enter the AA class, but, in time, the A class will equal the AA class, and, in many cases,

the A class bull will be far superior, especially if it "nicks" with the females of a herd it is mated with, and can maintain the *dual purpose* type along with a well-shaped milk vessel and high milk production.

It is only natural that breeders should go for the AA class animal, the lure of the imported pedigree is a hard thing to resist, but it must not be forgotten that there are AA class animals with poor udders and inferior milk production. The worship of a long AA pedigree is all very well in its way, but it is by the progeny that an animal produces that one judges the merits of a sire. It is a repetition of the work of our oldest stock-breeders, like Bakewell, the Collings Brothers, &c., who placed utility first, and they bred for that and that alone, and if modern stock-breeders are to succeed, they have to keep utility ever in mind.

Many Red Poll herds have been established on stock purchased from the Department of Agriculture of Victoria, and it is interesting to note from the report referred to at the commencement of this addendum, that animals bred in the "Victoria" herd and submitted for test by their present owners did well, notably "Victoria Highland Fling" (915 C), who, in the mature cow class, yielded in 273 days 12,645 lb. milk, 4.04 average test, 511.06 lb. butter fat and 30 lb. milk on the last day of the test.

Bull calves from the "Victoria" herd, at the State Research Farm at Werribee, Victoria, are sold for delivery at a month old at prices based approximately on the actual milk and butter fat record of the dam, at the rate of 1s. per lb. of butter fat yielded. Thus, a calf from a cow with a 400-lb. butter fat record is sold for 20 guineas, one from a 300-lb. butter fat cow for 15 guineas and so on. Bull calves from heifers on their first calf, before their first lactation record is completed, are sold for a set price of 10 guineas.

PASTURE FEEDING AND VITAMINS.

Writing towards the end of last year to the *British Australian*, Sir W. Arbuthnot Lane, one of the foremost medical men of the world, said:—"Australian butter is now arriving in large quantities on the British market. It is made from the milk of cows that feed in the open pastures all the year round, and is consequently very rich in vitamins A and D, which are particularly valuable to us all during the winter months. It is especially good for children because of its valuable property of stimulating growth and preventing rickets. Generally speaking, the butter which comes to England from the Continent during the winter is made from the milk of stall-fed cows, and is deficient in those vitamins which so materially assist the constitution to resist colds and kindred complaints."

RED POLLS.

THE IDEAL DUAL-PURPOSE BREED.

By A. J. Smith, Dairy Foreman, State Research Farm, Werribee.

The Red Poll herd of the Department of Agriculture was established under the direction of Dr. S. S. Cameron, Director of Agriculture, at the State Research Farm, Werribee, in 1913.* Since then it has made steady progress in demonstrating the economic possibilities of this breed for dairying and for beef production under Victorian conditions.

At the present time, owing to the intense competition in the British market, coupled with the natural disability of distance, it is clear that efficient production is essential. The old custom of producing beef from cattle of five and six years old is now over, and the demands of the local as well as the European market are all for small and early-maturing carcasses. To compete successfully for the trade, we must provide the article required, and for this purpose the Red Poll excels, particularly so as it also possesses the desirable characteristics of heavy milk production.

Although it is only within recent years that the Red Poll breed has become widely known throughout Victoria, it is one of the oldest English breeds. It originated two centuries ago by the merging of the Horned Red Norfolk and the Polled Suffolk Dun.

From an agricultural historian who summarized the features of these breeds, we learn that this union combined the two desirable qualities of milk and beef.

The Norfolk cattle were a hardy, early-maturing breed, light in bone, and deep-red in colour. They were not only an economic butcher's beast, but yielded high-quality milk.

The Suffolk Duns were larger framed, with an inherent ability to yield large quantities of milk, and produced a beef of excellent texture, at that time much favoured on the London market.

With this union as a basis, and the application of modern methods of breeding conjoined with rigid culling, there has resulted the Red Polls of to-day, possessing the characteristics of docility and early maturity, and they are usually persistent milkers, with a high average test.

In conformation they are fine in the region of the head and neck, back level with the tail well set on, wide in the loins, with hips well rounded and not prominent. They are a light-boned breed, with square-hind-quarters, deep body, well-sprung ribs, and well-developed udder.

They conform closely to the requirements of a dual-purpose breed, and are medium-sized—a mature cow being about 1,100 lb. live weight. They possess the special advantage of early maturity, and the fact that the milkers carry a fair bodily reserve of flesh has stood them in good stead during lean periods. These advantages, together with the fact that they can stand extremes of climatic conditions, have

* [The herd was founded in 1909, and was held successively at Edi and Boisdale before being transferred to Werribee.—Ed.]

led to their being well represented in countries so diverse as the Argentine, United States of America, Canada, South Africa, Kenya Colony, India, &c.

In the various Dairy and Beef Competitions in England and other parts of the world they have won conspicuous successes. In the London Dairy Show of 1924 they had the triple honour of being placed first on Inspection, in Milk Trials, and in Butter Test. In Milk Competitions they usually take second or third place to the Channel Island breeds.

For the production of baby beef on a live and dead meat basis, they have had similar successes. In Australia they have been coming more and more into favour for the following reasons:—

1. Ninety per cent. of the progeny of Red Poll bulls on grade cows are polled and of solid colours, mainly red.
2. The bulls, being prepotent, are very useful for grading up dairy herds.
3. The steers are early maturing and command good prices in the present-day beef markets.
4. They satisfy the requirements of those who require a dual-purpose animal, i.e., those who have to dispose of beef as well as milk to carry on cattle-raising with profit.

The foundation stock of the Research Farm herd at Werribee consisted of the following sires:—Tobacum 90AA, Nicotine 60AA, Belligerent 80AA (imp.), and Longford Major 58AA (imp.), which were carefully selected and mated to the following cows, *inter alia*:—Velveteen 2AA (imp.), Primrose League 1AA (imp.), Bullion 544D, Virginia 496D, Connecticut, Muria 491D, Asiana 323D, and Netherlana 492D, and it is from these cows that the bulk of the present herd is descended.

Descendants of these are to be found in most of the Red Poll herds in the Commonwealth, and they have done much in improving the standard of the breed and in bringing them under public notice.

That they possess the attributes of heavy and consistent milk production is shown by the following table of records at the Research Farm for the years 1921-22 to 1925-26:—

Herd Average for Years 1921-22 to 1925-26.

No. of Days in Milk—273.

Year.	Heifers.				Post Heifers.				Mature Cows.			
	No.	Milk.	Fat Test.	Butter Fat.	No.	Milk.	Fat Test.	Butter Fat.	No.	Milk.	Fat Test.	Butter Fat.
		lb.	%	lb.		lb.	%	lb.		lb.	%	lb.
1921–22	12	5,834	4·30	251·3	5	5,548	4·48	248·3	13	8,991	4·19	377·3
1922–23	11	6,001	4·16	249·8	6	6,504	3·37	219·5	17	8,788	4·18	365 6
1923–24	12	6,294	4·10	259·5	8	6,803	4·06	276·8	19	7,498	4·25	319·5
1924–25	6	6,444	4·05	261·1	2	8,289	3·74	310·1	10	8,062	4·29	345 5
1925–26	23	6,242	4 46	280·8	6	6,970	4·24	294·3	7	8,263	4·26	352·4

Highest Individual Records.

Name.	Lactation.	Days in Milk.	Milk.	Average Test.	Butter Fat.
			lb.	%	lb.
Muria	6th	365	14,972	5·90	885·0
Nictitana	6th	365	14,492	4·45	657·8
Tonga	8th	365	13,572	4·71	640·0
Birdseye	4th	365	7,146	6·53	547·0
Reparation	3rd	300	12,601	4·25	536 9
Cutty	3rd	365	11,278	4·72	532·0
Netherlana	4th	365	12,722	4·00	509·0
Cutty Sark	..	330	12,344	4·07	503·3
Bullion	6th	321	10,928	4 30	469·0
Avesia	5th	316	10,111	4·60	465·0
Virginia	7th	344	10,252	4·40	457·0
Brighteye	1st	365	8,335	5·34	444·8

It has been the policy of the Department to dispose of its surplus Red Poll stock on a production basis. The male progeny, for which there is always a firm demand, are disposed of on the basis of 1s. per lb. butter-fat of the highest yield of the dam. On this system the bull calf from a cow of a record of 400 lb. of butter-fat would be priced at 400s., or 20 guineas, that from a 300-lb. butter-fat cow 15 guineas, and so on. For the male progeny of heifers a fixed price of 10 guineas is charged.

In conclusion, it can be justly claimed that the Research Farm herd has conclusively demonstrated that the Red Poll breed is filling the niche in Victorian Agriculture as an all-round dual-purpose animal.

PLENTIFUL WATER FOR DAIRY COWS INCREASES YIELD OF MILK.

Experiments conducted at one of the dairy farms of the United States Government on the drinking habits of dairy cows indicate that a greater quantity of water will be utilized when available at all times than when offered but once a day Cows watered but once a day not only drank less, but also produced less milk than when watered at will from watering troughs. Cows watered twice a day drank as much as when watered at will, but did not produce so much milk.

THE GOVERNMENT COOL STORES.

THEIR PRESENT USE AND FUTURE POSSIBILITIES.

An Address by R. Crowe, Exports Superintendent, broadcast by 3LO, 20th January, 1927.

Perhaps it will not be out of place to say a little about our Government Cool Stores and briefly state the circumstances under which they came into existence, the work that is being done there at present, and their objects and future prospects.

The First Cool Stores in Victoria.

At the inception of the butter export trade away back in 1889, efforts were made to induce producers to manufacture butter of a uniform and high standard of quality suitable to place on the English market. With the increase in the number of factories this object was attained. Then it was found that before any success could be looked for in landing first class butter on the other side of the world, it would be necessary to have it cooled before placing it on a ship. At that time there were no freezing works in commission in the State. At Newport a freezing plant had been established by Messrs. Turnbull and Hotson, but owing to the bad prospect that season for the shipment of lambs it was not in use. The owners permitted the Government to use the stores for the freezing of butter, and operations were carried on there for two seasons, but the place was found to be inconveniently situated, and the machinery expensive to run.

In the meantime, the Melbourne City Council had built the City Markets at the corner of Spencer and Flinders streets for the sale of meat, vegetables and fruit, and other farm and orchard produce. Refrigerating space had been provided for stall-holders, but the stalls remained untenanted for two years, and the place came to be regarded as a "white elephant."

Arrangements were made by the Government with the City Council for the lease of the refrigerating accommodation, and butter was treated there for shipment. After the first year, additions to the refrigerated space were made. A couple of years afterwards more additions were made, and later further insulated space was added, until the total leased from the Council was 320,000 cubic feet.

At the inception of the trade, the Government treated butter for export free of charge. Then, a nominal charge was made, which was gradually increased. After a while, other kinds of perishable produce were received and frozen.

The Government, however, did not enter into the export trade, that is to say, it did not purchase produce in the ordinary way of business, but confined itself to the freezing and storing of produce intended by its owners for export or for sale on the local market.

The Government Stores.

The Government Cool Stores have been used since their inception as a training ground for exporters, and all firms engaged in the meat export trade in this State began their operations through these stores, first of all, on a small scale, to test the possibilities of export business,

and to ascertain if scope existed for such a business in Victoria. The first season a few hundred carcasses per week were treated. Then the following season the operations ran into thousands per week, and the third season thousands of carcasses per day.

When in a few years the growing requirements of those meat exporters who were successful could not be fully provided for at the Government Cool Stores, they built or else acquired freezing works of their own. Many who made trial shipments were not successful, some on account of what we call (for want of some more definite term) ill-luck, and some owing to a lack of adaptablty for the business, and they gradually vanished from the trade.

Another valuable purpose was served by the Government Cool Stores at different periods in the history of the export trade. Possibilities existed for the creation of monopolies to the detriment of the producer. In the event of producers suspecting that such a thing existed, the doors of the Government Cool Stores were always open for them to have their produce treated for export on their own account and shipped and marketed by themselves. Although this course has been frequently resorted to, such operations never assumed large dimensions. The existence of the Government Cool Stores has, however, always exerted a salutary influence.

In countries where such a safeguard as Government Cool Stores does not exist, it has been found necessary for Parliament to pass acts controlling, restricting, or prohibiting the operations of trusts or combines. In this State, the suggestion of such action has never been required.

Produce Received at the Stores.

Since the inception of the trade, nearly £60,000,000 worth of butter has been treated at the Government Cool Stores for export.

In addition, during favorable seasons, butter is stored there from the period of plenty to supplement supplies when production is below market requirements. Operations under this heading are necessarily variable and difficult to judge, owing to the impossibility of predicting the autumn rainfall. Sometimes such butter is stored in excess of requirements; occasionally, through no fault of any one concerned, a shortage is experienced, as occurred last winter, when some New Zealand butter had to be imported. This occurs once in five or seven years, and is not a regular happening.

Meat—that is, lamb, mutton, and beef—is treated for export and storage. On rare occasions, were it not for such stored meat, consumers here would have had to pay very much higher prices for meat than they did, or go without it altogether. One one occasion following the war, over 200,000 carcasses of lamb and mutton, put into store for shipment to the Imperial Government, had to be released for local consumption.

Provision is also made for the storage of rabbits and poultry.

Cheese intended for export is received at the stores, as well as that intended for local consumption, which requires to be held in order that it may mature. Cheese matured at low temperatures loses less in weight through evaporation. It is also of better quality than that matured in the old-fashioned way. Take last week,* for instance. One can imagine the huge losses that occurred in weight and quality at many places in the country where cheese is stored—butter-fat oozing

* Week ending 15th January, when a "heat-wave" lasting six days was experienced.

from the cheese and flowing over the shelves on to the floor. Under such conditions, thick rinds and poor quality are inevitable. Experiments have proved that the saving in weight alone more than pays for the cost of storage, and the storer has the benefit of an improved quality cheese, which brings a higher price on the market.

Eggs are also treated for export, and stored from the period of plenty to the time of scarcity, and were it not for cool storage, many people who now enjoy an egg with their bacon for breakfast, would have to eat—during April to the end of June—the bacon without any egg.

Perhaps in the storage of fruit the mutual advantages of producer and consumer are more pronounced than is the case with any other perishable food product.

The Government, following the success achieved at the Government Cool Stores, erected a demonstration Fruit Cool Stores at Doncaster many years ago. Some fruit-growers in that—the leading fruit-growing district in the State at the time—could not see any advantages in the cool storage of fruit, and refrained from utilizing the stores. They were content to follow the old practice of storing their surplus apples and pears in sheds and under trees and covering them with straw or other litter. The period of keeping fruit under such conditions was limited, and, after a time, the quality was anything but satisfactory.

The progressive fruit-growers who utilized the storage space provided for the first season made a proposal to secure to themselves alone the privilege of storing. This, of course, could not be granted by the Government, and the storage space was enlarged. All growers had to be treated alike and provided with similar privileges if they desired them.

Further demonstration stores were then erected by the Government at Burwood East, Diamond Creek, and Tyabb, and the results were so successful that the demands from other fruit-growing districts multiplied.

It was then arranged that the fruit-growers be given advances to enable them to erect and operate stores themselves, whilst the four Government demonstration stores were disposed of to the orchardists in the districts to be worked on the same basis.

No country in the world is now so well provided with cool storage as Victoria. There are 51 cool stores in the State which provide fruit storage with a capacity of 1,257,000 cases.

These stores have proved of immense advantage to producers, and likewise to consumers, who can now enjoy apples and pears in the best condition every day throughout the year. Needless to say, orchard operations have been extended to a point which otherwise would not have been reached.

Last season, it was impossible for the fruit canneries in the State to cope with all the fruit during the peak period. As every one knows, Williams pears, which are largely used for canning purposes, come in over a short period, and the same with peaches and apricots. It would be impracticable to provide canning plants and staff to adequately cope with the " flush " supply over two or three weeks. The canning factories forwarded over 100,000 cases to the Government Cool Stores last season, which were held there for some weeks, and returned for canning purposes. Thus, the canning campaign was spread over a longer period, giving regular work over a longer time. Were it not for cool storage. nearly the whole of this fruit would have gone to waste.

Pioneering and experimental work have been featured at the Government Cool Stores, and in consequence of persistent efforts much headway has been made. The results are made available for all engaged in the business of freezing and cold storage. For instance, certain varieties of grapes (particularly Ohanez) can now be kept in store for some months. Last season an experimental shipment to London turned out very successfully. A similar effort will be made this season, and when the methods to be adopted for success are amply demonstrated, grape-growers can be left to reap the benefit, and develop their grape-growing operations.

Certain varieties of peaches have also been successfully stored and shipped. One small shipment three years ago realized £1 per tray wholesale in London. Each tray contained 20 to 24 peaches, so that some of the peaches brought 1s. each.

Those engaged in citrus-growing are uncertain and timid regarding the possibilities of an export trade. It may be mentioned that oranges have been successfully kept at the Government Cool Stores for a period of five months. The temperatures and methods adopted are available to all concerned. There is no reason whatever why oranges cannot be successfully shipped to any part of the world.

Some Recent Experiments.

This season experiments have been made with the keeping of berries and soft fruits in a frozen condition. To-day,* I tasted strawberries and cream which had been in store for some weeks. It was simply delicious, and as fresh as the day it was prepared and placed in store. I have sampled raspberry and soda, and could not wish for a finer drink. The raspberries were placed in store over a month ago, and there appears to be no reason why they should not be kept at a temperature below freezing point in perfect condition for many months. It would meet all practical requirements to have them kept till the end of the summer, say, four or five months. In addition, I have partaken of frozen loganberry juice and soda, and this drink was also most palatable.

The oranges from which the orange juice available at the Flinders-street railway station is obtained are stored at the Government Cool Stores; and, were it not for cool storage, this delicious beverage would not be obtainable at present.

I have tasted passion-fruit juice and soda from our cool stores, and found it excellent. The period of cold storage of passion fruit is limited, but there appears no reason why the pulp or juice could not be kept frozen for any time desired.

Experiments in the storage of apricot and peach juice are in hand at the present time.

It is a fact that there is not a wholly satisfactory teetotal drink on the market. A great number of people to-day drink beer and whisky who, if a palatable and wholesome teetotal beverage were available, would not ask for alcoholic drinks. Though most of the "soft" drinks in demand during the summer will quench the thirst, probably they are really harmful.

As the storage of oranges, raspberries, strawberries, loganberries, and other fruits for their juices develops, fruit and berry growers will be encouraged to extend their operations to meet the increasing demand that is certain to follow. There is great scope along these lines, with

* 20th January, 1927.

advantage to everybody concerned—both growers, and particularly the consuming public.

In an official publication received from abroad only yesterday,* I notice that the consumption of ice cream in England last year was double that of the year before. In the United States it is increasing yearly, now averaging 2.8 gallons per head. The average minimum butter-fat content is 10 per cent., so that an equivalent to 173,500 tons of butter is consumed in ice cream yearly in the United States of America. The total production of butter in Australia in 1924-5 was 140,000 tons. If ice-cream were consumed here to the same extent, an equivalent of over 2,000 tons of butter would be absorbed in Victoria.

The Financial Position of the Stores.

Some time ago, the Committee of Public Accounts recommended that the Government Cool Stores be investigated by a Business Board. This Board comprised gentlemen of the highest standing and integrity in the community. They made an exhaustive investigation of the affairs and operations of the stores, and submitted a report. One paragraph reads:—

> "We find that the stores have been efficiently run and economically managed. . . . In the annual balance-sheets, interest, depreciation, rent, insurance, and other overhead expenses had to be debited to the whole of the stores, more than half of which was provided as a war measure, although that portion was not used or needed for present requirements."

Taking that portion of the stores which was used for ordinary business purpose, their report states:—

> "In point of fact, section A (that is, the portion used), after adjusting interest and depreciation thereon, has earned an aggregate net profit of £40,863 2s. 11d. in its operations for the twelve years."

Of course, most of those profits were made during the period of the war, when produce was stored for abnormally lengthy periods.

This conveys a very different impression from that usually held regarding the financial operations of the Government Cool Stores.

Apart from the business side of the subject and the many uses which the stores have served, perhaps it ought to be mentioned, in conclusion, that the first season they were in operation, namely, 1914-15, there had been a drought, and every cubic foot of insulated space in Victoria was utilized to the fullest possible extent, and were it not for the existence of the new Government Cool Stores live stock, equal to more than the total cost of the stores, would have been lost, in addition to losses actually incurred by stock-owners. Again, during the war, the Government Cool Stores saved the situation, and all the expenditure incurred in connexion with providing these stores would have been a mere bagatelle as compared with the disastrous losses which would certainly have been encountered by producers and the State, if the stores were not then in existence.

The Board of Inquiry regards the surplus space as a fine asset, and so it is. If the extra storage accommodation (provided as a war emergency) were not now in existence, it is highly probable that the officers of the Department of Agriculture would not be exerting themselves regarding the many new avenues for the use of cool storage, some of which have been indicated in this talk.

* 19th January, 1927.

OFFSET HARROWING WITH DISC HARROWS.

By E. J. C. Rennie, M.E., Senior Lecturer in Applied Mechanics and Agricultural Engineering, the University of Melbourne.

[The journal, *Agricultural Engineering*, mentioned by Mr. Rennie, is an American publication. The method referred to of using disc harrows is a convenient one under the special conditions where the strip of land to be harrowed is considerably to one side of the machine. It entirely eliminates the side draft. Mr. Rennie's article is published here in order to acquaint implement makers and others interested in the principle of the device.—Ed.]

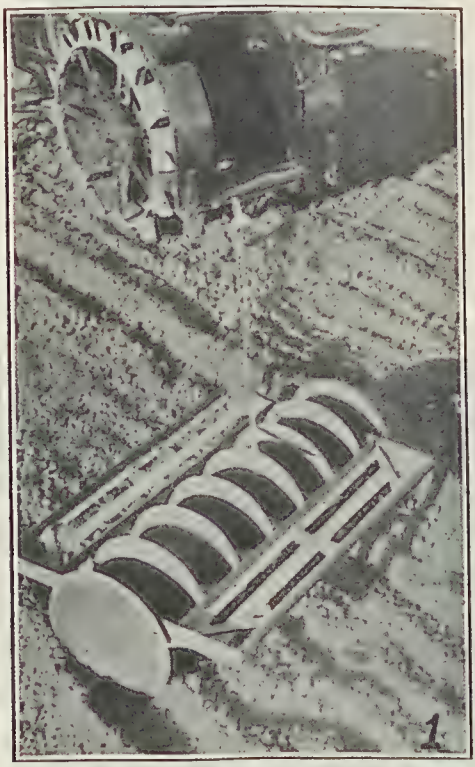


Fig. 1.—A single gang Towner disc harrow showing how the gang sets itself obliquely to the line of motion.

In a recent number of *Agricultural Engineering* (March, 1926) there appears a very interesting article, by E. G. McKibben, on the behaviour of a new type of disc harrow, and it is shown there that it is possible to arrange these harrows in pairs so as to cultivate a strip of land whose centre is considerably offset from the centre line of the tractor, but at the same time without any side pull on the tractor.

The special harrow used consists of a number of discs all capable of rotating about one centre line, and held in a very simple frame;

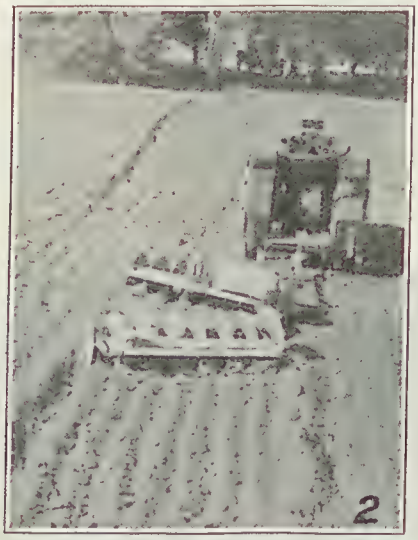


Fig. 2.—Two gangs working together showing offset.

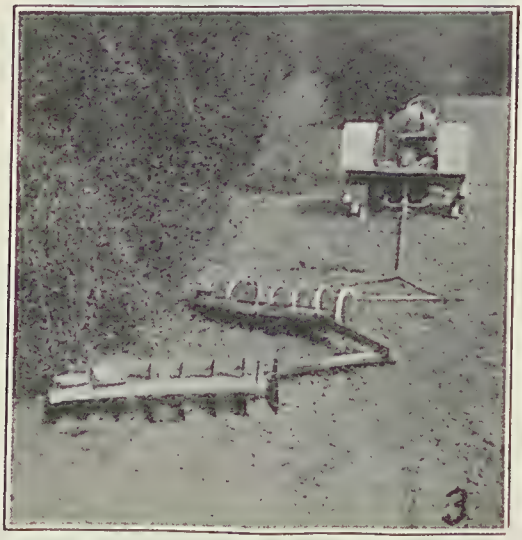


Fig. 3.—Shows very clearly the absence of side-draft.
(Note the position of the hinge point between the gangs with respect to the line of draft.

figure 1 gives a very good idea of the construction. The platforms on the front and rear sides are for the purpose of holding weights if necessary.

Let us consider first of all the use of one such gang. It is found that if the gang be attached to a tractor by a chain, the point of attachment to the harrow being about the point A, in figure 4, the gang will set itself in a position like that shown when the tractor moves forward. The position of the gang is quite stable; that is, if it is accidentally displaced to the left or right, it will when left free

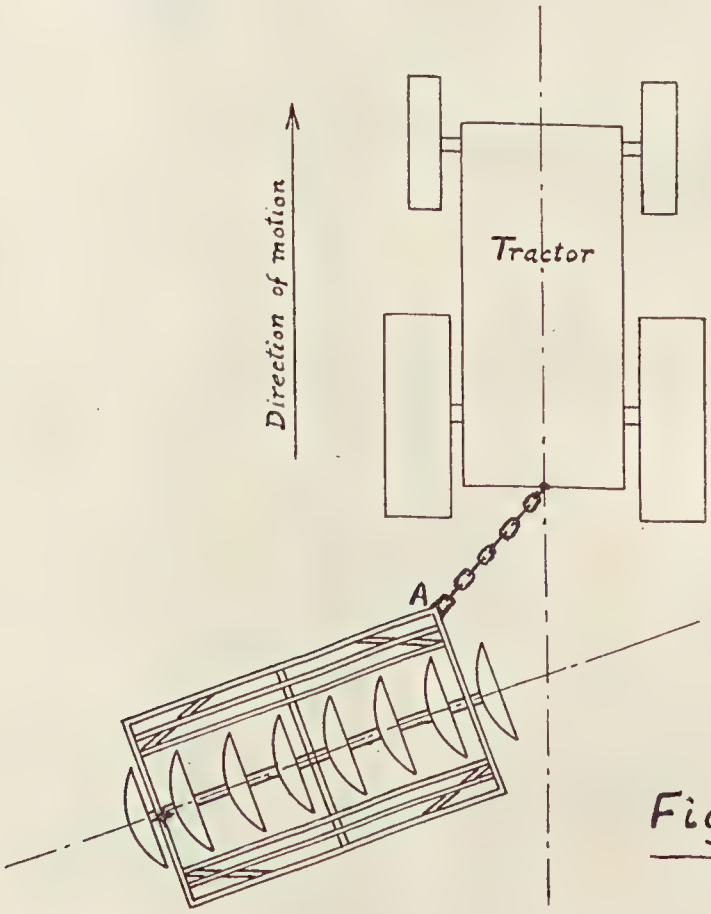


Fig. 4.

return to its normal position. The matter may be looked at in this way: the resistance to motion of the harrow through the soil may be considered as being made up of two parts, one along the axis and the other at right angles to the axis of the gang. The resultant of these two must be along the line of the chain, and the harrow will set itself automatically so that this is so.

With a single gang, the amount of offset can easily be regulated by simply altering the length of the chain. The angle which the discs

must make with the line of motion is of the order of 20 deg., and to obtain this the point of hitch, A, must be suitably chosen. This point will vary to some extent with soil conditions, depth of penetration, &c., but in ordinary cases will be about as in figure 4.

For given conditions, if the point A is altered, the effect is to alter the angle the discs make with the line of motion. Figure 5 shows the

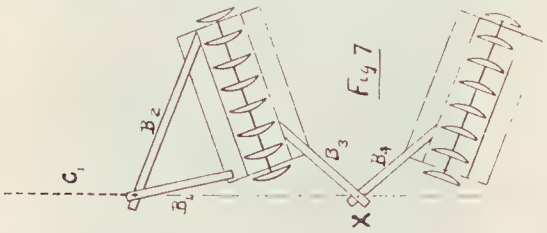


Fig. 7.

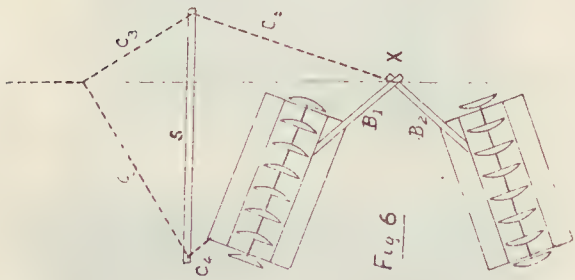


Fig. 6.

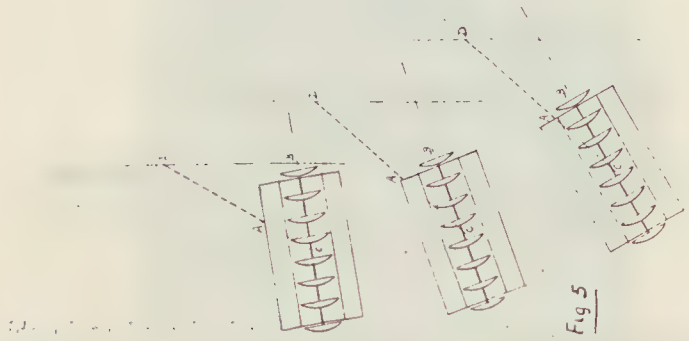


Fig. 5.

effect, and it is seen that increasing the angle A C B reduces the disc angle.

Owing to the combined effects of the pull in the chain and the resistance of the soil, the harrow tends to work deeper at the end nearest the tractor, and therefore to obtain equal penetration of all the discs the rear end must be weighted.

A grave disadvantage of the use of a single gang is that the chain makes a large angle (of the order of 40 deg.) with the direction of motion, and therefore the side pull on the tractor is excessive; in fact, it is in ordinary cases nearly equal to the drawbar pull in the direction of motion.

Combining Pairs of Harrows to Avoid Side Draft.

Mr. McKibben shows that it is possible to entirely eliminate side draft by combining two harrows so that their side forces are opposite

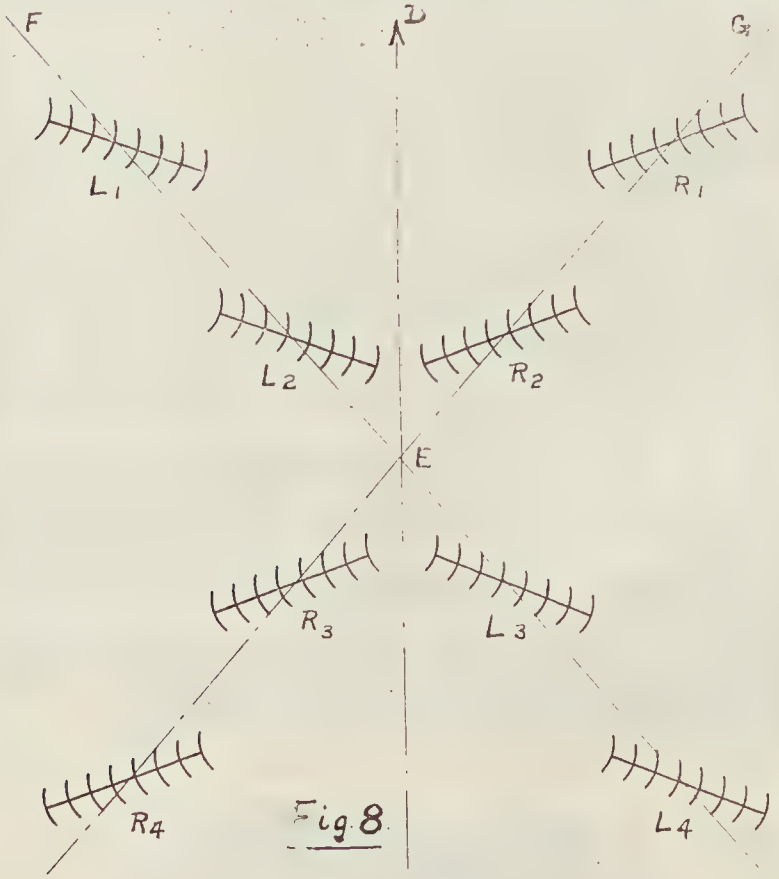


Fig. 8.

in direction, and thus balance each other. Such an arrangement is shown in figure 6 for left-hand offset, and in figure 7 for right-hand offset, using two gangs in each case. Photographs of such combinations at work are shown in figures 2 and 3. But other arrangements may be made. Consider figure 8; L_1, R_1, &c., represent gangs of disks; D E is the line of motion, and E F and E G are the directions in which each gang must be pulled or pushed. A combined harrow

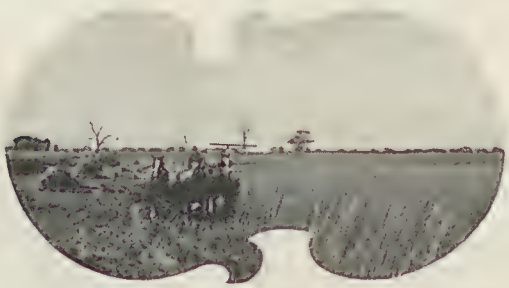
which can be pulled without side draft along the line D E can be made up by taking equal numbers of left-hand and right-hand gangs. For instance, a conventional arrangement consists of L_2, L_3, R_2 and R_3, or L_2 and R_2; these give no offset. But it is equally possible to have such a combination as L_1, L_2, R_3 and R_4; L_2 and R_3; L_1 and R_3, &c., provided that suitable hitches can be arranged; and such combinations will give offset and involve no side pull on the tractor. The fact that there is no side pull is shown very clearly in figure 3, where the draft chain comes straight out behind the tractor.

The original article does not give details of the actual hitches used, and the illustrations are not very clear in this matter. One comparatively simple arrangement would, however, be as shown in figure 6, where S is a spreader, C_1, C_2, &c., are chains, and B_1 and B_3 are rigid bars securely fixed to the harrow frames. B_2 could be replaced by a chain; C_4 should be short, or could be left out altogether, the left-hand end of the spreader being attached to the harrow direct.

Another possible arrangement, shown for right-hand offset, is shown in figure 7. Here C_1 is the draft chain from the tractor, or team of horses; B_1, B_2, &c., are rigid bars; but B_1 and B_4 could be replaced by chains. With arrangements such as shown, the possible amount of offset depends on the possible lengths of the bars B_1 and B_2 in figure 6, or B_1, B_2, &c., in figure 7. The rear gang is free to swing, since there is a hinge joint at X. Considering the left-hand offset arrangement, in turning to the right, the rear gang will swing back and both gangs will follow round the circle; in turning to the left, the gangs will come closer together.

The advantages of such an offset arrangement are (i) cultivation can be done close to trees in orchards or other places where offset is advisable; (ii) there is no uncut strip as where the usual arrangement is employed. The disadvantages are (i) the tractor is further from the edge of cut, and so steering is more difficult; (ii) in finishing between two rows of trees there will be a tractor wheel mark left on the cultivated soil between.

Figures 1, 2, and 3 are taken from the original article mentioned earlier. The work described is an interesting example of the application of engineering principles to agricultural problems.



A CROP AND FALLOW COMPETITION AND A FIELD TEST.

THE R. B. TURNER CUP.

Report of the Judge, H. A. Mullett, B.Ag.Sc., Superintendent of Agriculture.

Conceived at Nhill 26 years ago, and conducted there annually ever since, the worth of the crop and fallow competitions was not widely recognized until ten years ago. Since then the movement has spread like a ripple throughout the length and breadth of the Australian wheat belt. It is now one of the most important educational factors in our agriculture. It is true, of course, that Sir W. J. Clarke and others had sponsored farm competitions, haystack competitions, and ploughing matches prior to 1901, but none of them was of equal educational value to the Nhill system.

And now Nhill has gone one better in evolving a contest which is a combination of the ordinary crop and fallow competition, and an experimental plot. Later on, perhaps, the worth of this method will be recognized, and it may be widely adopted. In the ordinary crop and fallow competition, the principal educational advantage lies in the deductions as to which are the best methods that the judge may make after a thorough survey of the crops and an investigation into the methods by which they have been grown. Many valuable farm practices have been brought to light in this way. One of them is the practice of summer fallowing, the present widespread use of which in the Wimmera and older Mallee is directly due to attention drawn to its apparent worth by departmental judges in their reports of crop and fallow competitions.

A weakness of the system is that strictly accurate comparisons of the yields of crops grown in different ways cannot be obtained, because, of course, as between large paddocks, there may be many points of difference, such as soil, time of sowing, rainfall, &c. It is to remedy this that the Turner Cup competition was designed. The competitors are required to conduct a large scale experiment of simple design under strictly comparable conditions on their own farms. Each competitor conducts the same experiment, and thus some degree of corroboration may be looked for.

At Nhill each competitor was required to summer fallow 10 acres, and to winter fallow 10 acres alongside, on a site specially selected for its uniformity. These areas are cultivated similarly to bulk fields on the farm. It was expressly stipulated that the same variety of wheat (Federation) was to be sown on each plot, and on or about the same day. On each farm both plots were drilled with the same rate of seed and manure. The produce from each field was carted to the local weighbridge in separate loads, and weighbridge tickets furnished. The fields were re-measured after harvest under supervision, and net yields per acre calculated.

The scale of points was provided for the judging of the crops and fallows in the usual way, and, in addition, the layout of the field, the general conduct of the experiment, drilling, &c., were taken into account.

All competitors who completed the weighing of the produce of their fields received a uniform number of points on that score. The final award was for the highest aggregate over the period 1924-1926, i.e., three years, including two harvests.

The Competition, 1926.

Eight competitors satisfactorily completed the 1925 harvest. All of these entered again last year, and completed the competition. In one case, however, the conditions were not observed, as, owing to an unfortunate mistake, Mr. C. F. H. Reichelt lightly cultivated his winter fallow paddock when summer fallowing, consequently these results have been eliminated in calculating the average difference between crops on summer fallow and winter fallow.

All the competitors had located their plots on uniform paddocks of friable black soil. Disturbing factors, such as the presence of trees, had been avoided, and generally considerable judgment had been shown in locating the plots, so that there was the same type of soil on each. However, in one instance, if the plots had been placed running parallel to a slope instead of at right angles to it, more uniform conditions would have resulted.

Despite the fact that the rainfall for the year was only 11.87 inches, the yields averaged very close to 10 bags an acre—sufficient evidence of the careful preparation given the fallows. Almost all the crops were strikingly free from weeds. The drilling and binder work were most workmanlike.

Results of the Test.

In the 1925 harvest, an average increase of 2 bushels 42 lb. an acre was obtained for the crops grown on summer fallow as compared with those grown on winter fallow, and included in this average is a loss of 2 bushels 21 lb. an acre in the case of Mrs. Dahlenburg's plots, the summer fallow of one of which was obviously interfered with by the effect of some trees grubbed on the fallow. The increases obtained on the other seven plots ranged from 1 bushel 19 lb. an acre to 6 bushels 5 lb. an acre.

In 1926, eliminating Mr. Reichelt's, where the conditions were not fully observed, an average increase of 1 bushel 27 lb. an acre was obtained, ranging from a loss of 9 lb. an acre in the case of Mrs. Dahlenburg to increases up to 2 bushels 36 lb. an acre on the plot of Peter Bone.

Summarizing, it may be said that over the two years, considering fourteen pairs of plots, positive increases for summer fallow were obtained in twelve cases, and that in the other two cases the differences in favour of winter fallow were either negligible, or were due to conditions which obviously favoured the winter fallow plot. The average difference in favour of summer fallow for two years was 2 bushels 10 lb. an acre, and this includes two cases where there was a loss.

The society, therefore, has reason to be well satisfied with such positive evidence in favour of summer fallow. Had the plots been sown on weed infested paddocks, it is probable that there would have been greater differences in favour of summer fallow, owing to its being more effective than winter fallow under those conditions.

Details of Yields on each Pair of 10-acre Fields.

R. B. Turner Cup—Harvest Results, 1925 and 1926.

Competitor.	1925.		Difference due to Summer Fallow.	1926.		Difference due to Summer Fallow.
	Summer Fallow.	Winter Fallow.		Summer Fallow.	Winter Fallow.	
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
A. Schultz	29 33	23 28	6 5	26 51	24 42	2 9
J. and T. W. Rintoule. ..	33 26	27 24	6 2	28 54	28 0	0 54
P. Bone	34 31	30 59	3 32	35 3	32 27	2 36
W. E. Dahlenburg ..	29 30	27 10	2 20	30 22	28 16	2 6
G. Batson	26 11	23 26	2 45	32 49	31 30	1 19
F. W. Kluge (and R. Blackwood)	35 13	33 19	1 54	33 6	31 55	1 11
C. F. H. Reichelt ..	30 14	28 55	1 19	23 18	25 21	*2 3 (loss)
Mrs. W. E. Dahlenburg ..	26 40	29 1	2 21 (loss)	28 23	28 32	0 9 (loss)
Average Yields ..	30 43	27 50	2 53	30 47	29 20	1 27

* Excluding C. F. H. Reichelt's, where conditions were not observed.

Awards, 1926.

The final award is:—

F. W. Kluge (and R. Blackwood)—The R. B. Turner Cup (25 guineas), 918 points out of 1,000.

Then follow:—

Peter Bone, 913 points out of 1,000.

Alf. Schultz, 910 points out of 1,000.

At the conclusion of the judging of the fallows last year the winners were second to Mr. Alf. Schultz on the list; however, an attack of takeall reduced the yield of Mr. Schultz's crop, and the margin so obtained was sufficient to place Messrs. Kluge and Blackwood in the lead.

Mr. Kluge had worked his fallows as follows. The summer fallow was ploughed at the end of March, and harrowed in early July, then scarified a week later. In August, the field was spring-toothed, and again in September. After rain in November, a stroke of the harrows was given. The paddock was left untouched until springtoothed after rain in April; it was harrowed during mid-May, and sown with a combined drill, on the 10th June, with Federation wheat at the rate of 1¼ bushels an acre, and with 112 lb. of 24 per cent. super. Four days after it was harrowed, then sheeped from the end of July during early August.

The winter fallow was ploughed in July, and harrowed immediately after, and thereafter treated the same as the summer fallowed paddock.

Details of Award.

R. B. TURNER CUP.

Highest aggregate for 10 acres each summer and winter fallow, 1924, and wheat crop on the fallow, 1925; 10 acres each summer and winter fallow, 1925, and wheat crop on the fallow, 1926.

Competitor	Yield.	Absence of—		Evenness	Drilling.	General Conduct of Experiment.	For Weighing over Weighbridge.	Total 1926.	Total Fallow, 1924; Crop, 1925; Fallow, 1925.	Grand Total.
		Weeds.	Disease.							
Possible Points	50	30	30	30	20	40	100	300	700	1,000
F. W. Kluge (and R. Blackwood)	35	27	29	29	18	39	100	277	641	918
Peter Bone	37	27	27	29	18	35	100	273	640	913
Alf. Schultz	28	29	25	27	17	39	100	265	645	910
W. E. Dahlenburg	31	30	25	29	17	40	100	272	635	907
Geo. Batson, jun.	33	26	26	29	16	39	100	269	636	905
Mrs. W. E. Dahlenburg ..	31	25	27	24	16	37	100	260	628	888
J. and T. W. Rintoule ..	30	28	28	25	15	35	100	261	622	883
C. F. H. Reichelt	28	27	29	28	18	25	100	255	618	873

While judging these fields, it was observed that the summer fallowed crops appeared to be better stooled, and, if anything, slightly taller and a day or two earlier than those on winter fallow. In the majority of cases, it was possible to indicate which was summer fallow and which was winter fallow, merely by taking the densest crop. Differences down to 1½ bushels an acre were thus detected. In one instance, when judging Mr. Alf. Schultz's entry, the heaviest plot appeared to be that on winter fallowed land. The crop stated to be on summer fallow was definitely weaker, especially in patches which had not stooled well. This result was announced at the Salisbury Field Day. Mr. Schultz, however, on consulting his records, found he had mistaken the summer fallow plot for the winter fallowed one—a fact subsequently confirmed by Mr. Miller's plan of the field made at fallowing time.

In conclusion, I would like to congratulate the competitors and the society on the successful result of this valuable and educational competition, and would express the hope that it will be the forerunner of a great many more conducted by enterprising societies throughout the wheat belt on similar lines.

RUTHERGLEN CROP COMPETITION, 1926.

Report by W. B. Miller, B.Ag.Sc., Manager, State Farm, Rutherglen.

The Rutherglen district, in the past dependent almost solely on its mines and vines, is now maintained by a diversified agriculture, involving the keeping of stock and the growing of crops.

Wheat is the most important cereal crop. It is grown on a variety of soils under widely different methods of working, and the yields per acre vary considerably. But that they are not at a maximum is to be inferred from the fact that the Agricultural Society considers the average yield can be increased, and crop and fallow competitions, so successful in other districts, are a move towards that end.

The past year was not a good one for Rutherglen wheat-growers on account of the excessive winter rainfall. Eighteen and a half inches of rain fell between the March break in the dry autumn and the end of August. This is the heaviest rainfall recorded for this period, and it prevented some growers from completing the sowing of their fallow land, whilst others after ploughing under a dense growth of cape weed practically "bogged in" the crop late in the season.

On the other hand, those who sowed earlier on new and well-drained land have obtained satisfactory crops. Generally speaking, the wheat yield is lower than was expected earlier in the season, the water-logged condition of the soil having considerably reduced the vitality of the crops.

On account of the many types of soil which are to be found in the district, no one method of cultivation can be recommended for general adoption.

The cultivation of grey, cementy soils has been investigated by tests at the Rutherland State Farm, and of this type of soil it is possible to speak with some precision. It has been shown, for example, that deep ploughing is more suited to these soils than shallow ploughing, and that early fallowing, followed by cultivation sufficient to maintain a cloddy mulch, is more profitable than late ploughing with or without cultivation.

The following table of results illustrates these points:—

Cultivation Trials, Rutherglen.

Treatment of Plot.	Average Yield per Acre for Nine Years. Bushels.
Ploughed 3″ deep in July and cultivated	17.9
,, 5″ ,, ,, ,, ...	22.1
,, 7″ ,, ,, ,, ...	23.9
,, 9″ ,, ,, ,, ...	23.2
,, 5″ ,, ,, ,, ...	21.7
,, 5″ ,, ,, and left till seed time ...	13.3
,, 5″ ,, October, and cultivated	18.3
,, 5″ ,, ,, and left till seed time ...	16.7
,, 5″ ,, just prior to seed time	9.9

Winning Crop of Turvey, grown by Mr. R. Jack.

The Competition, 1926.

There were eight crops entered. Some were grown on fallow; others on land ploughed immediately before seeding. In some cases the paddocks had not been cropped for ten years; others had been constantly cropped.

In order to increase the scope of the competition, it is suggested that next year, in addition to the crop and fallow competitions contemplated, a section be included under which one half of the crop of each competitor will be submitted. An area of 25 acres only is too small from which to draw significant conclusions.

The detailed awards are given below. The points allotted for yields do not necessarily represent the estimated yield in bushels per acre.

25 Acres of Wheat of One Variety.

Competitor.	Variety.	Yield.	Purity of Type.	Freedom from—		Evenness.	Total.
				Disease.	Weeds.		
Maximum Points ..	.. .. ..	**35**	**20**	**15**	**15**	**15**	**100**
R. Jack	Turvey ..	31	19	14	15	15	94
F. Fuge (No. 1) ..	Free Gallipoli	24	19	14	13	14	84
D. J. O'Donoghue	Free Gallipoli	21	20	15	14	13	83
F. Fuge (No. 2) ..	Federation ..	22	18	14	13	13	80
McLaurin Bros. ..	Federation ..	18	20	14	14	14	80
J. H. Fuge ..	College Purple	18	20	14	13	14	79
W. G. Burrows ..	Turvey ..	16	18	13	14	14	75
A. Pollock ..	Turvey ..	15	19	14	12	13	73

Well-headed Crop of Free Gallipoli, grown by Mr. D. J. O'Donoghue.

Mr. R. Jack's winning crop of Turvey was 5 feet high, very dense and even throughout. The heads were large and well filled, though some dead heads and pinched grains were present. At the time of inspection it promised a very heavy yield, though the fact that it was somewhat rank rendered it liable to damage by storms.

The 25 acres selected for competition was the best part of a heavy crop grown on land which had been spelled as a cow paddock for ten

years, and had been regularly top-dressed to stimulate the growth of clovers; consequently it was in good heart. It was ploughed 5″ deep in April, 1926, harrowed and drilled in the same month with 60 lb. of seed and 1 cwt. of super. per acre. The crop was lightly fed off in May and June.

Mr. F. Fuge's crop of Free Gallipoli was part of a large paddock of wheat situated on a well-drained slope. As was common in the district this year, the heads were rather small, but were well filled. Points were deducted for an excessive number of Saffron thistles. In a "land" which Mr. Fuge was forced to re-plough before sowing, the Saffron seeds had evidently been brought to the surface, and had germinated thickly. The paddock was disc-ploughed in February, harrowed after rain, worked with the combine, and sown early in May. Seventy-five lb. of dry pickled seed and 90 lb. of super. per acre were used.

View showing how Rutherglen soils may be exhausted.

Left.—Light, dirty crop grown on a worked-out paddock, although fallowed.
Right.—Winning crop grown on ground ploughed from grass just prior to sowing.

Mr. D. J. O'Donoghue's crop of Free Gallipoli was sown on well-worked follow. Although more uneven than the above crops it had matured large well-filled heads, and should turn out well.

The fallow was ploughed in July 5½″ deep, harrowed in September, and again in November. In January it was disced, but the next cultivation was not till late in May, when it was necessary to "plough back" in order to kill the cape weed. Sixty-five lb. of seed and 1 cwt. of super. per acre were sown.

Messrs. McLaurin Bros. had a good crop of Federation, very true to type. The fallow was ploughed in August, harrowed in September and October, and spring-toothed in April. Seventy-five lb. of dry pickled seed was sown in May.

Pickling with dry copper powders to prevent stinking smut is recommended, as it also ensures a rapid germination.

The remaining crops were well above the average for the district, and were grown on fallow. In no case was a heavy working given the fallow in spring, the land either being left in the sod until after harvest, or else it was merely harrowed.

Such a practice is not in accord with the methods followed when the best results were obtained at the Rutherglen State Farm (see page 228). Further, the general experience of northern wheat-growers also is that it pays to harrow soon after ploughing, and to give at least one cultivation before harvest with the spring-tooth cultivator, the Wimmera scarifier, or the disc cultivator.

Sixty-eight lb. of seed and 95 lb. of superphosphate per acre were the average amounts used by competitors.

Growers evidently appreciate the importance of growing only proven prolific varieties, and of using seed that is true to tpye. In this connexion the following results of variety tests conducted at the Rutherglen State Farm are of interest:—

	Average yield for four years. Bushels per acre.
Free Gallipoli	28.7
Federation	26.5
Major	24.9
College King	23.3
Currawa	22.0

In conclusion I desire to thank the secretary, Mr. E. J. Turner, and the president, Mr. J. Hiskins, for their assistance at the time of judging.

ULTIMA CROP COMPETITION.

Report by R. G. Thomas, M.Ag.Sc., Inspector of Agriculture.

The standard of the crops inspected throughout the judging of the crop competition conducted by the Ultima branch of the Better Farming Association was very creditable. In some instances, however, crops of promising appearance had suffered as a result of the very drying weather experienced during the latter end of the season. Such conditions affected the crops in two ways; firstly, the direct effect of hot conditions weakened the plant by causing a demand for excessive amounts of moisture to be drawn from the soil through the crop, and, secondly, in that fungoid diseases, taking advantage of the reduced vitality of the plants, developed rapidly. This was evidenced in crops in which take-all and deadheads were very noticeable, although there had been nothing in the appearance of the crops prior to the unfavorable climatic conditions to indicate that the disease was present to any extent.

Take-all.

Take-all patches and the usual deadheads seen in crops are symptoms of the same disease; both conditions are caused by a definite fungus—a parasitic growth living in the plant tissues. The difference in the appearance of, and damage done to the crop, is probably determined by the stage at which the plants are attacked, and by the health of the crop. A healthy, vigorous crop will withstand the ravages of the disease much better than one developing under unfavorable conditions. The take-all fungus lives in the root and plant tissues, where it is able to draw on the moisture and plant food absorbed by the roots. Consequently the plant is more or less starved, according to the stage and vigour of the disease attack, and according to the supply of moisture and food available to feed both plant and parasite. When matured, the fungus forms seeds or "spores". These may often be seen as a black incrustation on the base of the stem. These spores are very tiny, but they are capable of living in the soil for some time, and of germinating under favorable conditions, and attacking another plant.

The only way to control the disease, then, is to ensure the destruction of these tiny seeds before another crop is available for attack. This is not a simple matter; the spores are on the base of the stalks and scattered through the soil. A good stubble burn will reduce their numbers considerably, and an endeavour must then be made to induce the remainder to germinate prior to the sowing of the next wheat crop. Oats are immune to take-all; therefore if the take-all infested paddock can be sown to oats, no host is provided on which the fungus can live. Since it is not capable of living independently, any spores that develop will die of starvation. This condition will apply also if the land is kept under well worked fallow, and, in addition, the condition of such fallow encourages the germination of the spores. The fallow must, however, be kept very clean, as barley and other native grasses will carry on the disease.

When sowing the succeeding wheat crop, seeding should be delayed as long as it is consistent with safe practice, and a liberal dressing of superphosphate given to encourage vigorous growth.

The question of the application of these general principles of control will depend on the circumstances of the grower and on the severity of the attack. If a crop is only lightly affected, probably a stubble burn and good fallow will suffice. In the case of a bad attack, it would be advisable to introduce at least one oat crop prior to the fallow. If oats are required for feed or hay, the growing of this crop suits the farmer from a financial point of view.

Then, again, the success of any measures adopted will depend on the class of soil treated, and on the climatic conditions prevailing during the period. It is recognized that on grey limy patches of soil, diseases are more prevalent than on the surrounding soils; weeds, similarly, are difficult to control. A year under fallow, but during which the rainfall is light (as was the case with the fallows on which the competition crops were grown) is not as favorable to the germination and consequent destruction of disease spores as a similar period during which the rainfall is abundant.

The Competition.

Best 100 Acres of Wheat.

The creditable number of fifteen entries was received. This speaks well for the interest taken by farmers in the movement for "Better Farming."

First place is awarded to Mr. P. R. Olson, 95 points; second, Mr. W. H. Kent, 93 points; and third, Mr. T. W. Atkins, 89 points. Details of the awards are shown in the following table:—

Competitor.	Yield.	Trueness to Type.	Absence of Weeds.	Absence of Disease.	Evenness.	Total.
Possible points.	**35**	**20**	**15**	**15**	**15**	**100**
P. R. Olson ..	35	19	14	13	14	95
W. H. Kent ..	35	18	14	12	13	92
T. W. Atkins ..	29	19	14	13	14	89
J. N. Whinfield ..	29	17	14	13	14	87
G. Young	31	17	12	12	14	86
M. W. McGuinness ..	28	18	14	12	12	84
P. W. Sloan ..	33	10	13	14	14	84
A. E. Curnow and C. Heil	27	18	12	11	13	81
D. M. McKenzie ..	30	17	11	11	11	80
H. M. Hamilton ..	28	18	14	9	11	80
C. J. Newall ..	25	16	14	13	12	80
A. V. McKenzie ..	25	18	12	9	10	74
A. White	22	17	13	10	12	74
H. C. Ferrier ..	20	14	12	8	12	66
J. S. Jury	22	16	9	9	10	66

Note.—The marks allotted for yield do not necessarily indicate the estimated yield in bushels per acre.

Mr. P. R. Olson's winning crop was of a variety known in the district as "Crossbred 53." The wheat was tall, and carried a long, fairly lax, and tapering head, with velvet chaff and a slight tip awn. It has been identified as an early strain of Crossbred 53 or Zealand Blue, bred at the Roseworthy Agricultural College, South Australia.

The crop was fairly dense, uniform, and true to type. It contained very few weeds, was noticeably free of smuts, and showed only very slight indications of take-all.

Mr. W. H. Kent's crop of Joffre was also heavy. Few weeds were present, but points were lost on account of some patches of take-all on the lighter ground, and a little flag smut.

Mr. T. W. Atkins' crop, Bald Early, though not so heavy as the above-mentioned entries, was also very nice and even, showing very few foreign heads or weeds, and only an odd deadhead and a little smut.

The methods adopted in the production of the leading crops are shown in the accompanying table.

In all cases fallowing was carried out early; the depth of fallowing varied from 2 to 3 inches, and cultivation of the fallow was commenced during the winter months. The amounts of seed and manure sown varied from 55 to 80, and from 90 to 100 lb., respectively. The average amount of seed sown, including all entrants in the competition, was 67 lb. per acre, and of superphosphate, 90 lb. per acre.

TABLE SHOWING METHODS OF PRODUCTION BY LEADING COMPETITORS, ULTIMA CROP COMPETITION.

Competitor.	Method and Depth of Fallowing.	Time of Fallowing.	Cultivation of Fallow.	Variety, Quantity Seed, per acre, and Method of Pickling.	Quantity super. per acre.
P. R. Olson ..	Scarified, 2½ inches	July ..	Harrowed July, scarified September, part scarified and part springtooth cultivated March; sown with combine mid-May and harrowed a week later	Crossbred, 53 lb.; Copper powder. 55 lb.	90 lb.
W. H. Kent ..	M.B. ploughed, 2½ inches	July ..	Harrowed July, springtooth cultivated and harrowed August, springtooth cultivated end October, springtooth cultivated and harrowed end March, sown with combine and harrowed early May	Joffre, 80 lb., formalin	100 lb.
T. W. Atkins ..	Scarified, 2 inches	March (summer fallow)	Scarified July and September to 2 inches, harrowed end March and springtooth cultivated; sown with combine and light harrows end May and early June	Bald Early, 65 lb., formalin	90 lb.
J. N. Whinfield ..	M.B. ploughed, 2 inches	Early July ..	Springtooth cultivated July, August, and September; harrowed November, springtooth cultivated end April, sown combine and light harrows early in May	Rajah, 75 lb., formalin	93 lb.
G. Young ..	Scarified ..	July ..	Worked with scarifier and light harrows four times after rain to November; scarified March, harrowed April, sown with combine and light harrows mid-May, harrowed again few days later	Ranee, Bald Early, 60 lb., formalin	90 lb.
M. W. McGuiness ..	Springtooth cultivated, 2½ inches	April (summer fallow)	Springtooth cultivated June and July, skim ploughed September, springtooth cultivated end April, drilled early in May and lightly harrowed	Rajah, Bald Early, 55 lb., copper powder	90 lb.
P. W. Sloan ..	M.B. ploughed, 2 inches	July–August ..	Harrowed after plough; springtooth cultivated September, harrowed November; springtooth cultivated early May, sown with combine mid-May to early June	Rajah, Bald Early, 60 lb. formalin	90 lb.

PLANT PATHOLOGY.

STUDIES IN EUROPE AND AMERICA.*

(Continued from page 90.)

By D. B. Adam, B.Agr.Sc., Plant Pathologist.

(3.) Horticultural Conditions, with particular reference to the Field Control of Disease in the American States.

The Prevention of "Black Spot."

In 1924 New York State produced 23,800,000 bushels of apples. The estimated reduction in yield that year due to "Black Spot" (*Venturia inaequalis*) was 6,346,000 bushels—is an appalling loss from a disease which is so thoroughly amenable to control by judicious spraying.

Spraying or dusting is the main plant disease control measure used in an orchard. A thorough appreciation of the principles underlying any spray practice is not enough. If the measures are to be effective and profitable the fungicide must be prepared accurately and applied correctly within a definite and limited period.

The problem of spraying apples for the control of "Black Spot" has passed the stage of fundamental investigation; its control each year is comparable to the routine control going on continuously in a chemical factory. In New York State, as well as in certain eastern States, a Spray Information Service has been organized. This service gives advice based on local knowledge of the diseases, condition of growth, and weather forecasts.

Since "Black Spot" and Codlin Moth cause considerable loss in some of our districts, a more detailed account of the organization and methods of this service seems worth while.

In New York the information service is conducted from the State College of Agriculture, under the supervision of a plant pathologist and an entomologist. Field assistants with good training in plant pathology and entomology are stationed in apple-growing districts as early in spring as is necessary, and continue therein during the growing period, usually six months. These assistants are appointed on the recommendation of the leaders, subject to the approval of the executive committee of the County Farmers Organization. The Farm Bureau work is supported, financially and materially, by Federal, State, and County authorities in co-operation. Each assistant has a uniform area of an extent which he can cover by motor car. Early in the season he visits the orchardists of his group to ensure that they have a sufficient spray outfit for their orchard area, that it is in good order, and that they have all the materials necessary for spraying.

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* Report on investigational work in England, Europe, and United States of America. The first part of Mr. Adam's Report was printed in the *Journal* for January last, and the second part in the *Journal* for February.

"Black Spot" of apples is a disease caused by a fungus. In the condition of disease two living organisms are concerned—the apple tree on the one hand and the fungus on the other. The winter form of the "Black Spot" fungus exists and matures in the fallen leaves. The maturation of the fungus and the expulsion of spores capable of infecting the tender young apple leaves and flowers are affected by the temperature and moisture to which the fungus is exposed during the winter. Similarly, the time of emergence of leaves and buds of the tree in spring normally is determined largely by the climatic conditions experienced up till such time.

At a certain time in spring spores of the fungus are floating about in the air. The tender young leaves and flowers are in a susceptible condition, and if weather conditions are suitable, infection and the disease "Black Spot" are sure to follow.

The principle in spraying is to place a protective layer of fungus poison over parts likely to be attacked, in time to protect the plant from infection by spores. One practical difficulty lies in the fact that fresh leaves are being produced continuously during the early, susceptible period of plant growth, and it is economically unpractical to keep these leaves so covered.

The exact time to spray, therefore, depends largely on conditions during early spring, conditions which vary from year to year, and cannot be forecast any length of time ahead. In some districts conditions from season to season apparently are so uniform in their effect on the fungus and tree that a rule such as "Spray when the blossoms show pink" will give very good control every year, or at least five years out of six. Unfortunately, such a "rule of thumb" method breaks down in many districts, and it is in such places that the information service is fully appreciated.

Returning to the New York State system, we find that an important duty of the field assistant is to decide upon the most suitable time for making spray applications. He must have as accurate information as possible about such things as the growth of the buds, leaves and flowers of the trees, the development of the parasites he is to control, and the probable weather conditions for a few days ahead. His information about the trees is gained from his own observations during trips he makes round the country. The assistant usually has one or two test orchards typical of his area where he can study the development of parasites more closely, and where his directions, given from time to time, are followed closely. Sometimes such orchards provide informaton on which slight modifications of procedure in future years may be based. The assistant's information regarding weather is supplied nightly by wire from the Weather Bureau, a specal forecaster for the purpose being assigned the job. Basing his judgment on the information so received, the field assistant must decide the most opportune time for making spray applications. This information is conveyed to interested farmers by circular letter, the first of which, sent out a few days before the spray is likely to be used, gives information on the spray, its strength and any modifications desirable in using it with special varieties of apple. Being so prepared the grower awaits a telephone or similar rapidly conveyed message which is to urge an immediate application. This message is confirmed by a card sent through the mail next day. Two of these

circulars, the first of which had, in addition, a sketch showing the life history of the fungus, are inserted below to illustrate the system:—

Farm Bureau Spray Inf. Service, //13, May 5, 1926.
Subject:—Pre-Blossom Spray on Apples—W. D. M.
Dear Sir,

The scab fungus is nearly ripe in the dead leaves on the ground. It will develop rapidly during the present warm weather, and will probably shoot its spores during the next rainy period. If weather remains clear until the full pink only one pre-blossom spray will be recommended for all varieties of apples. If rains are forecasted before the pink, a pre-pink spray warning will be sent for McIntosh and other varieties that scab badly. Spraying at the end of a rainy period is of no value against scab.

When: A telephone warning will be sent to co-operators followed by a card to all when a spray should be applied.

What With:

Lime sulphur (32 deg.)	2½ gallons.
Arsenate of lead (powder)	2½ pounds.
Water to make	100 gallons.

or

Dust with 95.5 sulphur lead arsenate.

Bordeaux is risky and is not advised for pre-blossom sprays.

Why: This spray is primarily for apple scab. The arsenate of lead is also important for the control of skeletonizer, green fruit worm, bud moth, leaf roller, and other chewing insects.

How: Spray or dust trees from both sides. A complete cover of new growth of leaves or buds is what you are after.

Yours very truly,
F. W. W.,
County Agent.

Kingston, N.Y., May 10, 1926.

Farm Bureau Spray Information Service, //14.
Subject: Pre-Blossom Spray on Apples—W. D. M.
Dear Sir,

The Sunday night weather wire was as follows:—"Showers indicated late Monday and on Tuesday slightly warmer, Wednesday fair."

The co-operators were phoned Monday morning to cover their McIntish and other tender varieties to play absolutely safe. It was impossible to reach the rest of you by mail to-day after the weather wire of Sunday night.

A small amount of the scab fungus is now ripe in the dead leaves, and there is a possibility of some scab infections if the showers come close enough together to keep the leaves wet continuously for from 14 to 18 hours. However, it is not likely that infections will occur during these showers. The larger part of the scab fungus will shoot in later rains, probably during the blossoming period.

When: Spray or dust each variety of apples when the cluster buds separate unless another rainy period threatens. Another notice will be sent if a rain period is forecasted before the buds reach the open cluster bud stage.

The pre-blossom spray should not be omitted.

Especially important for McIntosh, Delicious, Winesap, Rome and Winter Banana.

Yours very truly,
F. M. W.,
County Agent.

"Spray Rings."

It seems difficult for the average small farm orchardist to give his orchard proper care, especially spraying. He generally finds that spraying takes too much time when other farm work is pressing him, and furthermore, owing to high initial costs of good high-power spray machinery, he may work with an inefficient hand-outfit.

The consequence of spraying under these circumstances is that much time and labour is consumed, and maybe the results are only moderately good, and costs are so high that the work is unprofitable. Such conditions may mean that the orchard will not be sprayed or, if sprayed, the

work will not be done at the right time or frequently enough. To meet these conditions in certain American States, numbers of "Spray Rings" have been organized. These small co-operative associations organized by the farmers interested, adopt a constitution and by-laws, and exist for the purchase and use of power spraying machinery, materials, and the services of a competent spray operator.

The area of mature orchard or of potatoes to be sprayed in a ring must not be large; one that can be covered in five or six days is a convenient size. These community power spray rings are capable of quite wide application with a variety of crops. The interest taken in them is shown by the fact that in Illinois in 1922, 35 spray rings were in operation; in 1923, there were 49. In Pennsylvania in 1923, 220 spray rings reached 1,934 potato farmers.

(To be continued.)

BUG-MARKED PEACHES.

REPORT TO THE DIRECTOR OF AGRICULTURE ON AN INVESTIGATION TO DETERMINE A CHEMICAL METHOD OF REMOVING RUTHERGLEN BUG (*Nysius vinibor, berg*) MARKS PRIOR TO CANNING.

W. R. Jewell, M.Sc., B.Met., F.I.C., F.A.C.I., Agricultural Research Chemist, and G. T. Levick, B.Agr.Sc. Assistant to Entomologist.

Introduction.

The damage caused to peaches by the Rutherglen Bug takes the form of brown marks, from $\frac{1}{64}$ to $\frac{1}{8}$ an inch in diameter and extending into the flesh to a maximum depth of about $\frac{1}{16}$ of an inch. These spots are clearly visible on peaches that have been badly punctured, but with those that are only slightly affected, the damage is not apparent until after the skin has been removed. The bug-mark does not affect the wholesomeness of the fruit.

Although microscopic examination showed that the cell walls had not been ruptured there was apparently some alteration in texture accompanying the discolouration, as peaches badly marked always exhibited a roughened, tough exterior after the removal of the skin.

It is probable that the brown discolouration is the result of oxidation following the puncture of the skin by the bug, but there is no definite evidence that the bug does not inject into the peach some substance which aids discolouration. It would appear that marks made in the early stages of development of the peach persist subsequently and increase in size as the peach grows.

The problem of finding a chemical treatment which would make these peaches fit for canning was made more difficult by a number of limiting factors:

(*a*) The peach must be edible after treatment and subsequent canning;

(*b*) The provisions of the Pure Foods Act prohibit the addition of any preservative or foreign matter other than syrup;
(*c*) The cost must not exceed at most £4 per ton of fruit if the treatment is to be a commercial possibility;
(*d*) There must be no recurrence of the marks during canning or subsequent storage.

Review of Experiments Conducted.

As the investigation proceeded it was clear that the problem could be attacked along three lines:—

1. To bleach the marks after the removal of the skin;
2. To bleach the marks before the removal of the skin;
3. The complete removal of the affected zone.

(1) The skin is removed by passing the halved peach through a weak boiling solution of caustic soda, followed by washing in a revolving drum under a spray of water. It was found that the marks were most difficult to remove even with the strongest bleaching agents. Strong sulphurous acid was the only re-agent found to be at all efficacious, and even then about three hours' immersion was required. The peach was not edible after treatment nor did it comply with the Pure Foods Act.

It is unnecessary to enumerate the many bleaching and other re-agents that were tried. It was concluded that, with the limitations imposed, it was impracticable to bleach out the marks after the skin had been removed. There was some evidence to show that the skinning process aggravated the trouble by increasing the resistance of the marks to bleaching.

(2) After a large number of unsuccessful experiments on peaches before the removal of the skin, it was found that 2 minutes' immersion in boiling, 1 per cent. citric acid solution (and, to a lesser extent, in boiling water alone) made a considerable improvement. Some peaches thus treated showed practically no marks after skinning, while in others the number of marks visible was considerably reduced. Unfortunately, this treatment affected only the surface of the marks, and when the process was tried out on a commercial scale, it was found impossible to prevent the caustic bath from removing some of this altered surface layer, thus exposing the brown colour underneath. Even if this treatment removed 95 per cent. of the marks on the peach, the treated peach was still unfit for canning because of the remaining 5 per cent. Further, the efficacy of the treatment appeared to vary with different varieties of peaches, and it was clearly evident that the process was not satisfactory on a commercial scale.

(3) Apart from the fact that attempts to bleach the marks were unsuccessful, the rough, tough surface of the marked peach prevented its being a perfect canning fruit even if the brown colour were removed. Hence experiments were next carried out to ascertain if the whole affected area, to a depth of approximately $\frac{1}{16}$ of an inch, could be removed by chemical means, without adversely affecting the remainder of the peach. A satisfactory solution to this problem was found while investigating the actual effect of the caustic soda skinning bath.

A boiling, dilute solution of caustic soda removes the skin by dissolving the pectin cells that exist between the skin and the peach proper. Text books on canning state that dilute caustic solutions have no effect

on the peach itself, except after prolonged immersion. Ordinarily from 1 to 5 per cent. solutions are used, and the normal loss by skinning is said to be about 10 to 12 per cent. It is difficult to see how this loss can be accounted for unless some of the peach is dissolved or unless the layer of pectin cells is much thicker than supposed.

Skinning experiments were conducted using 1, 2, 3, 4, 5 and 10 per cent. caustic solutions, the time of immersion in each case being 30 seconds. With 1 per cent. solution the loss in weight was about 6 per cent. With from 2 to 5 per cent. solutions the loss was from 9 to 10 per cent., while with 10 per cent. solution the loss on skinning was about 14 per cent. In order to determine whether the caustic soda actually did dissolve some peach tissue as well as pectin cells, these skinned peaches were again immersed in the boiling soda solutions for a further 30 seconds. The 1 per cent. solution removed a further 10 per cent. of the original weight of the peaches. The 2 to 5 per cent. solutions removed a further 12 to 13 per cent., and the 10 per cent. solution a further 16 per cent. These results, of course, would vary with the state of maturity of the peach.

These experiments demonstrate that boiling, dilute, caustic solutions do actually attack the peach tissue even during very short immersion; but what is more important, they provide a very simple solution of the problem under investigation. It was found that the second immersion, followed by washing, removed the whole of the marks and altered tissue, and left a perfectly sound peach, unaffected by the caustic soda and entirely free from this re-agent, with sharp edges and a surface as smooth as that of an originally unblemished peach. Even peaches badly marked by the bug could be successfully treated by a further immersion for 30 seconds.

Treatment Recommended.

The treatment recommended is as follows:—Adopt the ordinary practice of using a 3 per cent. caustic soda solution in the skinning bath and immerse for 30 seconds. After washing, remove marked peaches as usual at the inspection belt and return to the skinning bath. Badly marked peaches require a second treatment. The process introduces no extra machinery or solutions into the cannery. Marked peaches, whether for a first or second treatment, are removed and returned to the caustic bath along with fresh peaches entering the bath. The only extra cost involved is the labour necessary to carry the peaches from the inspection belt to the caustic bath, plus a little extra caustic soda, a matter of a few shillings per ton of fruit.

Commercial Scale Experiments.

This proposed treatment was carried out on a commercial scale at a cannery, and the following are typical of the results obtained:—

A. 70 peaches, specially selected as showing no bug-marks, were skinned, after which 52 were perfect while 18 (or 26 per cent.) showed bug-marks, and, therefore, were not suitable for canning. These marks were not visible prior to skinning. The 18 marked peaches were put through the caustic bath again, and 16 (or 90 per cent. of those marked) came out perfect, while 2 still showed marks. These 2 were unmarked after a further immersion.

B. 108 peaches showing bug-marks were skinned. Thirty came through clean and 78 were marked. For purposes of comparison 18 of these were canned without removal of marks. The remaining 60 were re-treated, after which 45 (or 75 per cent.) were clean and 15 still showed bug-marks. Of these, all but 1 were free from marks after a further immersion.

Sound peaches and marked peaches that had been once and twice treated were then passed through all operations to the finished, canned article. On opening these tins, experts stated that it was impossible to distinguish between sound and treated peaches as regards colour, texture, perfection of cooking and taste.

The proposed process is remarkably simple and cheap, perfectly effective, and without any deleterious effects on the peach.

The adoption of this simple and harmless process should mean a considerable saving to canneries on peaches, which, although apparently clean, still show bug-marks after skinning. It should also benefit growers to a very large extent in that fruit that has heretofore been rejected can now be successfully treated and canned.

Summary.

1. The problem of finding a chemical treatment to make fly-marked peaches fit for canning was made more difficult because of a number of limiting factors.

2. It was found impossible to bleach the bug-marks after the removal of the skin, except after prolonged immersion in strong sulphurous acid. The peach was not edible after this treatment.

3. Two minutes immersion in boiling 1 per cent. citric acid solution (and, to a lesser extent, in boiling water alone) before skinning, made a considerable improvement. But as the improvement was not complete and was at best only superficial, the process was not commercially successful. No other method of bleaching was found that was at all effective prior to skinning.

4. Contrary to published statements, boiling, dilute, caustic soda solutions re-act with the peach tissue, even when immersed for very short periods.

5. It was found that immersion for 30 seconds in dilute, boiling, caustic soda solution removed the marks and the altered tissue from bug-marked skinned peaches. The treated peach is perfectly sound, is unaffected by the alkali, and has sharp edges and a surface as smooth as that of an originally unblemished peach.

6. In practice bug-marked peaches can be made fit for canning by passing them a second time through the skinning bath, after they have been removed from the inspection table subsequent to skinning. A 3 per cent. caustic soda solution is recommended in the skinning bath and the immersion should be about 30 seconds. Badly marked peaches will require a second treatment.

7. This process is very simple, cheap and effective. Peaches so treated were canned, and it was impossible to distinguish them from peaches originally unblemished. The treated peach is perfectly wholesome (as would be expected seeing that peaches normally pass through the soda bath), and complies with the requirements of the Pure Foods Act. Considerable saving should result, both to canneries and to growers.

SUMMER FALLOWING FOR WHEAT.

An Address by H. A. Mullett, B.Ag.Sc., Superintendent of Agriculture, broadcast through 3LO.

If most Australian wheat crops were dependent solely on the rain that happens to fall on them while they are growing, it is safe to say that the average yields obtained would be 50 per cent. lighter than they are, and that implies that the industry could not be profitably conducted. What largely makes commercial production possible is the fact that by bare fallowing it is possible to carry forward for use of the crop moisture caught and stored during the previous year. The rainfall of any given year can be augmented by anything up to 4½ inches in this way. Thus, a 14-inch precipitation, insufficient of itself for the production of any but light crops, becomes 18½ inches—ample for reasonably heavy yields.

The term "bare fallow" usually means maintaining the land in a condition of tilth and free of any plant life for about a year. But merely to plough up the land and later work it down to a reasonably good seed-bed is not necessarily to conserve the maximum amount of moisture, or, indeed, any at all. The best results are only to be obtained by those who understand something of the scientific principle underlying fallowing. With these I have dealt fairly fully in an earlier address, which has been reprinted in pamphlet form, and is now available free of cost to those interested. To-night it will be sufficient to remind you that it is necessary first to trap your rain in the soil and then retain it there by means of a loose dust mulch, and that the best results are not attained by haphazard methods.

In the wheat belt the summer is practically rainless, and the wet season does not begin until about April. The crop is sown during May and June, and fallowing begins soon after. Thus at least three months' wet weather normally occurs before the fallowing begins, and four, and possibly nearly five, months before it is finished.

At first all the rain soaks into the parched soil, but sooner or later, especially during heavy falls, the soil cannot take it up fast enough. A good deal runs off the paddocks down the drains, and some may lie about in shallow pools and soon evaporates.

When you bring out your ploughs in the first week in July, you are entitled to congratulate yourself on being early enough for first class winter fallow, but even then you can never hope to trap the rain which has run off or evaporated during the three preceding months. There is only one way in which you can do it, and that is by summer fallowing—a method which, in recent years, has been successfully employed in the Wimmera. Not only does summer fallow catch the early rains, but it is advantageous from several other points of view.

Let me briefly describe how summer fallow is made. First, the land is opened up in February, March, or April, and lies bare for fourteen of fifteen months before it is sown. Needless to say, the method cannot be employed regularly on those soils which cannot be broken up in the absence of rain; but, on the other hand, there are extensive areas which are more easily broken up when dry than when wet. On very loose soils it is sufficient in the first operation to merely stir the

soil 2 or 3 inches deep with a spring-toothed cultivator, but generally the use of heavier implements, such as a Wimmera type scarifier or, more often than not, a plough, will be necessary. The one-way disc cultivator also does satisfactory work. If the soil breaks up rough, it will be desirable to harrow it, and then generally it may be left until after the drilling season.

The early tillage of the soil promotes a profuse germination of rubbish when the first rain comes. Sheep should be given access to the paddock, but once the weeds get too far ahead it will be necessary to get rid of them by cultivation. At this stage generally a scarifier will be equal to cutting the weeds, and at the same time stirring the soil to a depth of about 3½ inches; but, if a light implement was used for the first operation, a plough may have to be used now.

Later, as rubbish appears, it must be killed by using the lightest implement that will do the job satisfactorily. As the spring advances, the aim should be to create a well-defined mulch of loose, mellow soil about 2½ inches deep, overlying a firmly consolidated seed-bed. On soils which have a tendency to run together, the mulch should be left comparatively cloddy, but on good, loamy soils it can be fairly fine. The effect of the mulch is to reduce to a minimum the evaporation of the moisture previously stored in the soil. As the summer advances an occasional "sheeping" of the fallow will suffice to prevent any oats from seeding, but, should half an inch or so of rain fall, it will generally pay to give a quick harrowing to break any crust that may have formed on the surface. It is very important to recognize that a crusted surface is one through which moisture evaporates at a far faster rate than through a loose surface. By permitting the crust to remain, the whole of the moisture previously stored may be lost.

In the following autumn, after the weather breaks, the land can be worked up and then, after allowing sufficient time for weeds to germinate, sown with a combined drill.

It should be obvious that land which does not plough satisfactorily in the winter, once the surface has been broken, should not be summer fallowed. There are areas in the Goulburn Valley which come within this category. The loose surface created by summer fallowing tends to form a mush in winter, over which it would be difficult to get teams.

Earlier in the evening I spoke of some advantages the practice has, additional to that of efficient moisture conservation. One is that the germination of weeds is stimulated. You will recognize that to clean land of weeds one must first cause them to germinate, and later kill them by sheep and by cultivation. Nothing finer for the promotion of a good sprout of rubbish on a paddock has been discovered than to summer fallow it. Thus the system can be employed to clean up the dirtiest paddocks on the farm.

When a paddock which it is intended to fallow is noticed to be particularly foul with weeds, it is sometimes found desirable to restrict the first operation to a light cultivation. In this way the seeds are not buried deeply to become a menace in later years. They sprout immediately, and may be destroyed.

And may I offer a word of warning to the new chum who may be summer fallowing a dirty paddock for the first time? Don't do it

unless you can cope early with the growth promoted; otherwise the paddock may have to be re-ploughed, and at the best an unsatisfactory result obtained.

It will be fairly obvious, I think, that, rather than attempt to summer fallow all the land it is intended to crop, it will be most economical to treat half in that way and winter fallow the rest. Thus the available labour on the farm can be most economically distributed. Some of the heavy work can be undertaken in February and March, when the teams would otherwise be idle, and the balance can be left till after the wheat is sown.

The practical advantages in respect to weed-killing and the distribution of labour should stamp the practice as worthy of adoption wherever it can be employed. Even were no extra yields obtained, many advocates of it would be found. But there is reasonably satisfactory proof that crops grown on summer fallow, on the average, yield several bushels an acre more than on winter fallow. Perhaps the most convincing evidence on that score comes from the Nhill district. A competition known as the "Turner Cup" was organized by the Agricultural Society there. The competitors were required to prepare two areas of 10 acres each in a uniform field—one as summer fallow and one as winter fallow. Each field was worked similarly to the bulk areas of fallow on the farm. Later the plots were sown under uniform conditions with Federation wheat, also with the same quantity of manure, and the yield from each crop was carted to the weighbridge in separate loads. The experiment has been continued for two harvests, and the results for the second year are just to hand.

The averages obtained conclusively demonstrate that superior yields are obtained on summer fallow. Last year the differences in favour of summer fallow ranged from 1 bushel 54 lb. an acre to 6 bushels 5 lb. an acre, and this year from nothing at all to 2 bushels 36 lb. The results for the two years from the plots of the seven competitors show an average difference in favour of summer fallow of 2 bushels 10 lb. an acre.

The trials were conducted in all cases on black clay loam soil, and confirm up to the hilt the personal experiences of those who have tested the practice for themselves. All the crops were sown on land comparatively free from weeds. Had weedy land been chosen, there is little doubt that there would have been still greater differences in favour of summer fallow. Almost all the summer-fallowed crops are better stooled than those on winter fallow, and close observation shows them to be a shade taller and, if anything, a few days later in maturing. The difference is due to the greater supplies of moisture and plant food conserved in the soil.

These differences in the crop were so marked that, when judging these competitions, it was possible for me to indicate almost in every case which crop was on summer fallow and which on winter, without any previous knowledge of their disposition. At one farm the crop picked out as on summer fallow was stated by the competitor to be on winter fallow. It appeared that here at least a substantial superiority in favour of winter fallow had been obtained. The result was announced at the Field Day at Salisbury, and also to the gathering at Longerenong;

but, later on, the competitor discovered he had mistaken the lay-out of his plots, and wrote correcting the error. The incident demonstrates with striking clearness the fact that there are characteristics which clearly distinguish the summer fallow crop when there is a winter-fallowed one alongside for comparison.

To conclude, I would briefly recall the points I have made. Summer fallow means fourteen or fifteen months' fallow. It may be profitably employed on wheat farms where there is loamy land. It permits of a better distribution of labour on the farm. It promotes a better germination of weeds than ordinary fallow, and, lastly, it raises the yields by several bushels an acre.

It cannot be employed on hard soils or those which water-log in winter, and it should not be used on Mallee sand-hills likely to blow. It is true that some dry feed may have to be sacrificed in March, but when the rains come the quickest and best grazing on the farm will be obtained on this paddock. The growth of weeds should not be allowed to develop too strongly.

Finally, it is best to have some of both types of fallow.

My slogan for to-night is, "Lay down some summer fallow; start to-morrow."

PIG FEEDING EXPERIMENTS.

AT THE SALE AGRICULTURAL HIGH SCHOOL.

By R. T. Archer, Senior Dairy Inspector, and A. J. Gill, Senior Herd Tester.

A very interesting and successful demonstration of fattening pigs was recently concluded at the Sale Agricultural High School Farm, and aroused a great deal of interest in the surrounding district. It is intended to arrange for further experiments to be carried out there, and it is hoped that other Agricultural High Schools scattered throughout the State will follow the example that has been set, and so become valuable demonstrating and experimenting centres.

A pleasing feature of the demonstration was the hearty co-operation of the officers of the Education and Agricultural Departments. Mr. Friday, the Head Master of the School, and Mr. Elston, Farm Manager, entered whole-heartedly into the scheme and spared no labour to make the test thorough.

The result of the experiment was a revelation to many people in the district of the profits to be derived from pig-farming, and there is little doubt that great changes will follow in the methods of feeding that have obtained there. During the demonstration many farmers saw a self-feeder for the first time, and were able to appreciate what a saving of labour it can effect.

The Experiment and its Financial Result.

The pigs used for the test were marked by a numbered tag in the ear so as to ensure identity. A careful record of all food consumed was kept, and the pigs were weighed once a month.

The mother of the litter tested was Latrobe Bell, a pure Middle York; the sire was Jerseyholm King 4th, a Large White. The experiment revealed the money-earning capacity of the sow, for the litter used in the experiment realized, when just over five months old, the sum of £56 13s. 4d.

The full litter which was farrowed on the 1st October, 1926, numbered fifteen, but soon after birth two died. A few weeks later the sow and litter were awarded first prize at the Sale Show. Unfortunately a third member died later and so only twelve were reared, and it was this twelve that were used for the test. On the 15th February last the sow gave birth to a litter of eighteen; this farrowing, following so soon after that on the 1st October, was not designed, but was due to the sow having accidentally got out of her sty to the boar.

Jerseyholm King 4th.—Pure-bred Large White—Sire of Litter.

On 22nd December, 1926, the twelve pigs chosen for the test were divided into two even lots. The total weight of Lot A was 351 lb., an average of 58.3 lb.; the total weight of Lot B was 349 lb., an average of 58.1 lb. Similar food was fed to both, but that of Lot A was fed wet in the sty three times daily, while Lot B was given its food from an automatic feeder, the supply in this case being unlimited. Lot B was given the run of a small paddock, but owing to the dry weather it contained no grass.

The daily ration consisted of crushed oats 30 per cent., pollard 30 per cent., crushed barley 30 per cent., meat meal 5 per cent., bone meal 5 per cent. During the first part of the test they were allowed separated milk at the rate of one gallon each; later this allowance was reduced to half a gallon.

The twelve pigs were sold on the 7th March, when they were 5 months and 7 days (158 days) old.

	£	s.	d.	£	s.	d.
The total amount received for them was				56	13	1
The total cost of the food fed to them was ...	23	13	4			
To which may be added, say, 10s. each as cost of additional food required by sow when suckling them	6	0	0			
				29	13	4
Gross profit				26	19	9

or £2 4s. 11d. per pig.

The total live weight of the twelve pigs when killed was 2,125 lb.—a ton litter.

The average live weight of the sty fed lot was 178 lb.

The average dressed weight of the sty fed lot was 133 lb.

The average live weight of the outdoor pigs was 176 lb.

The average dressed weight of the outdoor pigs was 126 lb.

Latrobe Bell.—Pure-bred Middle York—Dam of Litter.

The Object of the Test.

The object of the test was to demonstrate that pigs could be successfully fattened without the expenditure of a large amount of capital on elaborate sties. By the use of an automatic feeder the labour in pig feeding is very greatly reduced. It is not necessary to fill the feeders oftener than once or twice a week, while with animals in the sty they must be fed three times daily, and in addition the sty must be cleaned out regularly. Another fact not to be overlooked is that when pigs are roaming in the open their manure is all deposited in the soil, but in sty-feeding a considerable amount of it is lost.

Comments on the Experiments.

While the results from the outdoor lot compare very favorably with the sty-fed lot, it was an exceptionally dry time, so there was no grass available. Previous experience goes to show that with ample green feed very considerable saving in grain is effected. The sty-fed lot consumed 2,539 lb. of food for an increase of 719 lb. or 3.53 lb. of food per lb. of gain live weight. The outdoor lot consumed 2,504 lb. which produced an increase of 707 lb. or 3.54 lb of food per lb. of live weight gain. Thus in each case it cost for food about four pence to produce a gain of 1 lb. in the pigs.

Certain points must be borne in mind when comparing the results. Prior to the tests the pigs were all sty-fed. The outside pigs were removed from the sty, consequently it took a day or two for them to settle down. Again in the sty they had received moistened food; outside they were given it dry. These changes gave them a set-back for a while, but after the first period they commenced to overtake the sty-fed pigs, as is shown by the average gains for the different periods.

The Sty-fed Lot.

Lot fed in paddock with automatic feeder.

Table Showing Average Periodic Gain per Head of Both Lots of Pigs.

—	Gain during first period of Test.	Gain during second period of Test.	Gain during third period of Test.
	lb.	lb.	lb.
Sty-fed	45.5	44.5	29.5
Fed from self feeder in the open ..	38.5	46	33

An outstanding feature of this demonstration is the fact that the pigs were bacon weights when five months and one week old. The lightest was a sow that did not thrive from the commencement; when killed she weighed 115 lb. dressed weight. The heaviest, a barrow,

Details of Periodic Increases in Weight of Pigs in the Test.

Number.	Sex.	Initial Weight, 22.12.26.	Age Days.	Second Weight, 18.1.27.	Increase in 27 Days.	Average per Day.	Third Weight, 15.2.27.	Increase in 28 Days.	Average per Day.	Live Weight, 7.3.27.	Increase in 20 Days.	Increase per Day.	Dressed Weight.	Loss in Offal.
		lb.		lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	
Lot "A"—Sty Fed.														
112	B	74	83	126	52	1·92	176	50	1·78	200	24	1·20	157	..
73	B	48	83	90	42	1·55	133	43	1·53	166	33	1·65	121	..
105	B	64	83	115	51	1·88	164	49	1·75	199	35	1·35	147	..
85	B	50	83	90	40	1·48	133	43	1·53	160	27	1·75	120	..
88	S	58	83	103	45	1·66	144	41	1·46	173	29	1·45	126	..
94	S	57	83	100	43	1·59	143	43	1·53	172	29	1·45	126	..
Total ..	..	351	83	624	273	..	893	269	..	1,070	177	..	797	..
Average ..	..	58·5	83	104	45·5	1·68	148·8	44·8	1·60	178·3	29·5	1·47	133	25 %
Lot "B"—Open Air, Self Feeder.														
90	B	67	83	107	40	1·48	154	47	1·67	193	39	1·95	133	..
128	B	48	83	88	40	1·48	136	48	1·70	170	34	1·70	122	..
104	S	65	83	103	38	1·40	149	46	1·64	186	35	1·75	127	..
127	B	58	83	96	38	1·40	143	47	1·67	164	21	1·05	126	..
109	S	55	83	88	33	1·22	127	39	1·03	152	25	1·25	115	..
123	B	55	83	97	42	1·55	146	49	1·75	190	44	2·20	134	..
Total ..	..	348	83	579	231	..	855	276	..	1,055	198	..	757	..
Average ..	..	58	83	96·5	38·5	1·42	142·5	46	1·58	175·8	33	1·65	126	28 %

weighed 157 lb. dressed weight. This pig turned the scale at 176 lb. live weight (equal to 132 lb. dressed weight) at 4½ months. The average dressed weight of the sty-fed lot was 133 lb. and of the outdoor lot 126 lb. The majority of pigs do not attain these weights until six months old.

The difference in the rate of growth suggests another important phase in the management of pigs. By selecting the quickest growers from a litter and breeding from them, in a few generations a strain will be developed which will make much more economical growth than an average pig to-day.

In the last 20 days one of the pigs fed outside averaged an increase of 2.2 lb. per day while the daily increase of another was only 1.05 lb. This is where the scales come in. If the pigs do not put on somewhere near a pound a day there will not be much margin for profit. Whether they are putting on satisfactory weight can only be determined by periodical weighing, and those not thriving well should be culled. It is useless feeding animals which will not show a profit.

2. 1.

These two made the most rapid growth.

No. 1 was 128 lb. carcass weight in 4½ months, and 157 lb. carcass weight when 5 months and 7 days old.
No. 2 was 113 lb. carcass weight in 4½ months.

Of one thing in pig farming there is certainty, and that is that mongrel pigs will not pay; therefore the use of a mongrel boar should always be avoided.

Details of Food Consumed by Pigs in the Test.

Six Pigs—Sty Fed.

Crushed Barley.	Crushed Oats.	Pollard.	Bone Meal.	Meat Meal.	Skim Milk.	Total.
810 lbs.	775 lbs.	770 lbs.	60 lbs.	71 lbs.	53½ gal.	..
At 1.04d.	At 1.05d.	At 1.14d.	At 1.5d.	At 1.82d.	At 2d.	..
£3 10 2	£3 7 9	£3 13 1	7s. 6d.	10s. 9d.	8s. 11d.	£11 18 2

Total food consumed 2,539 lb. (including 53 milk solids.)

Initial weight 348 lb. Final weight 1,070 lb. Increase 719 lb. equals 3.53 lb. food per lb. live weight gain.

Average gain per pig daily 1.60 lb.

Six Pigs—Open Air—Self Feeder.

Crushed Barley.	Crushed Oats.	Pollard.	Bone Meal.	Meat Meal.	Skim Milk.	Total.
780 lbs.	770 lbs.	770 lbs.	60 lbs.	71 lbs.	53½ gals.	..
At 1.04d.	At 1.05d.	At 1.14d.	At 1.5d.	At 1.82d.	At 2d.	..
£3 7 7	£3 7 4	£3 13 1	7s. 6d.	10s. 9d.	8s. 11d.	£11 15 2

Total food consumed 2,504 lb. (including 53 lb. milk solids.)

Initial weight 348 lb. Final weight 1,055 lb. Increase 707 lb. equals 3.54 lb. food per lb. live weight gain.

Average gain per pig daily 1.57 lb.

As in other tests this proves the possibility of the pig industry in Victoria. We can rear and fatten a large number of pigs but we must have an outlet. The English market offers that outlet.

MANURING OF VINES.

A Lecture by F. de Castella, Viticulturist, broadcast through 3LO.

The season for vineyard manuring is approaching, and the question arises, "What is the best form of manure to apply?"

The vine is not a greedy plant; it thrives on land classed as poor from the usual agricultural stand-point. We cannot, however, take grape crops from the land indefinitely without replacing the plant food removed by the crops. The inexorable law of restitution asserts itself itself, and a time inevitably arrives when the abundant production of the first few years slackens off, and unless recourse be had to manuring, yields ultimately cease to be remunerative.

Opinions of practical growers are often contradictory and sometimes misleading. Some, indeed, disbelieve in manure for vines. Certain soils contain large stocks of the necessary plant foods, nevertheless the day of reckoning must come, sooner or later; usually sooner. There is overwhelming evidence that it pays to manure vines. It is the heavily-manured blocks that yield the heavy crops in Australia as well as in Europe. By judicious manuring we can maintain the productiveness of the early years, and in many cases improve the yields of even young vineyards by supplementing the supply of a plant-food element, present in the soil in insufficient proportion. Restitution should commence early in the life of a vineyard; it is much easier to maintain productiveness than to restore worn-out vines.

Too much is sometimes expected of manuring. It is only one of the factors governing the yield. The others are tillage, pruning, and disease control. No manure can give bountiful crops without adequate tillage. A grower may talk learnedly about nitrogen, phosphoric acid, and potash, when the element his vines are crying out for is iron. Not in a manurial sense, however; I mean iron in the metallic form—the implement behind the horse.

Nor can manure replace water if the lack of this is the crop-limiting factor. Heavy manuring, indeed, renders the vine more exacting in its moisture requirements.

What to apply, how much to apply, and when and how the application should be made are the chief problems that present themselves. Their solution is not nearly so easy as might be thought.

Unfortunately, soil analysis cannot help as we might wish. It can enlighten us as to the total stocks of each element the soil contains—information that is, indeed, very useful; but it cannot tell us exactly how much is immediately available to the vine.

Some persons look upon having their soil analysed as almost on a par with sending one's pass-book to the bank. They expect that deficiencies will be revealed and useful additions clearly indicated. This optimistic view has long since been discarded. We should regard analysis in its proper light—of great value to the soil investigator, but inadequate as a guide to manuring.

A better way is to make the vine itself speak by means of experimental manure plots—the rational method that has proved of such value in the case of wheat. Unfortunately, results are much slower in the case of a deep-rooted perennial such as the vine. Much good work has been, and is being, done in this way, both here and in other countries.

Another guide of value is the requirements of the vine; in other words, the quantities of plant-food elements removed annually by the grape crop. Fortunately, we need only consider four elements; the others are present in the soil in inexhaustible proportions. These four are nitrogen, phosphoric acid, potash, and lime. It is estimated that a 5-ton crop per acre of fresh grapes removes from the soil, 33 lb. of nitrogen, 9 lb. of phosphoric acid, 27 lb. of potash, and 71 lb. of lime.*

In what way can these substances best be replaced?

If I were asked what is the best manure for vines, I should reply—stable manure, and plenty of it. Not only does it restore removals in approximately the correct proportion, but it supplies organic matter or humus—that queer substance that exercises such potent functions in connexion with the fertility of the soil and its ability to retain moisture.

Ten tons of stable manure every third year replaces the removals made annually by a 5-ton crop of fresh grapes.

Unfortunately, stable manure is scarce; it cannot be procured in anything like the quantity required. In practice, we are compelled to fall back on artificial fertilizers, supplemented by green manuring to supply the organic matter these do not contain, thus countering the humus depletion that occurs in well-cultivated vineyards under our hot inland sun.

Let us briefly consider the four essential plant foods.

Nitrogen promotes vigorous growth of cane and leaf. To vintage heavy crops we must have strong healthy vines. It is nevertheless possible to have too much vegetative growth—vines that produce wood at the expense of fruit. Nitrogen in excess is thus undesirable. The quality of the fruit, and, in extreme cases, even the yield, may suffer. Vines over supplied with nitrogen are more prone to fungus diseases. In our warm climate nitrification is active, and the vine less exacting as regards this element than in colder regions. Nitrogen is of great

* Based on Muntz' exhaustive investigations in the vineyards of Southern France. These are not, of course, "hard and fast" figures. Various factors may cause a certain amount of variation. Nevertheless, they constitute a useful guide under conditions prevailing in Victoria.

value whenever it is desired to increase growth, but it should be applied with caution; unlike the other three elements, excessive applications can actually prove injurious. It is well to make sure that lack of vigour is really due to nitrogen deficiency. Application of this element is of little or no use if the poor growth is due to faulty soil conditions, such as bad drainage; or to root parasites, animal or vegetable.

Phosphoric acid gives tone to the vine and quality to its products, rather than stimulation of vegetative growth; it promotes the setting of the fruit at blossom time. Most Victorian vineyard soils are poorly supplied with this element, and, in addition, the vine seems to absorb it from the soil less readily than it absorbs nitrogen and potash. Hence it is that heavy applications of it pay. Though the crop removes only 9 lb. annually, it pays to apply eight to ten times this quantity.

Potash is absolutely essential to the vine, which is distinctly a potash-loving plant. Fortunately, most of our soils are well supplied with it. If not immediately available, it can be released by gypsum—a dressing with which is thus equivalent to a potash application. This element gives tone to the vine and quality to its fruit. It promotes a healthy dark-green colour in the foliage. It also has a marked corrective action in vines suffering from over-production. To soils deficient in potash its application is very necessary. Even in soils fairly well supplied it often gives positive results.

Lime has, in many of our soils, a true manurial value, that is usually denied to it. The vine removes from the soil more than twice as much lime as potash, and yet many of our soils actually contain less lime than potash. Outside the Mallee and the Wimmera, where limey soils are the rule, lime dressings are of great value. The value of lime and gypsum as soil improvers is well known. The action of the latter at the rate of a ton and a half to the acre, in rendering stiff soils more friable, is truly remarkable.

From the above we may conclude that in the majority of our vineyards phosphoric acid is the element that it pays to apply. The light dressings which benefit the wheat crop in so striking a manner are inadequate in the case of the deep-rooting vine. Annual applications of 5 cwt. per acre and over of superphosphate, or its equivalent, are common in the Mildura district in the best-bearing vineyards. For vines that are not irrigated, about half this quantity should suffice.

Potash, preferably in the form of sulphate, is generally beneficial, especially in land not well supplied with this necessary element—1 cwt. per acre is usually sufficient.

Nitrogen gives positive results in cases where growth is not sufficient. The condition of the vine is the best guide. If sufficiently luxuriant, nitrogen may actually prove harmful, and should be withheld.

Applications at the rate of 1 cwt. ammonium sulphate, $1\frac{1}{4}$ cwt. sodium nitrate, or 2 cwt. of blood manure, are equivalent, and are usually sufficient.

Remember that it is possible to over-apply nitrogen, but it is scarcely possible to apply too much phosphoric acid, potash, and lime. An over-application of these last three is not wasted, as the soil will retain the surplus. Application in excess of early requirements is, however, not good business.

Commercial fertilizers, containing the different plant-foods already mixed, are largely used. Sometimes they contain a certain constituent in excess of requirements; sometimes the price is too high. Concerning values and prices, full information will be found in the January issue of the *Journal of Agriculture* in each year. By applying the unit-values, as therein explained, to the analysis on the tag, a grower can ascertain if he is being charged too much for any given manure.

The time for application of fertilizers is of importance. In the first place, we must remember that the crop of one season has been largely built up during the vegetative cycle of the previous season. It follows that the vine cannot fully benefit from a manure application before about eighteen months have elapsed. Some benefit usually accrues the first year, but the complete measure takes longer. It is this tardy response that leads to doubts as to the efficacy of vine manuring.

Even the immediate benefit takes longer than is often thought. The mistake is sometimes made of distributing the year's quota in several different applications throughout the season. This is quite illogical. The vine absorbs almost the whole of its phosphoric acid and nitrogen in the big rush of growth before blossom, *i.e.*, in October. Later on, this is distributed where it is required. A dressing of superphosphate or nitrogen, applied after blossom, is practically useless to the vine during that season, though it will benefit the crop of the following year. Potash absorption continues later; nevertheless, the whole year's manurial application should be made before the vine starts its growth. Winter is the time-honoured season to apply manure, and there is no reason to depart from this practice.

Artificial fertilizers are applied in different ways. They may be broadcast and ploughed in; they may be drilled in, or they may be distributed in plough furrows. All three methods give good results, and the vine ultimately benefits. For quick results, localization seems advisable, and the placing of the manure in two furrows, 6 to 8 inches deep, one on each side of, and a couple of feet away from, the vine row, is perhaps the best way. Manure-sowing attachments are obtainable that can be fixed to one furrow of a plough. These are convenient, and enable the quantity applied to be accurately controlled.

Artificial fertilizers should be supplemented by green manuring wherever possible. Under irrigation this is easy. Various green crops are favoured, peas and tick beans being among the most popular. In addition to organic matter, these legumes enrich the soil with an appreciable weight of nitrogen assimilated from the air. The seeds are drilled in early autumn with a couple of cwt. of superphosphate, on the recently irrigated land. Active growth starts at once, and the resultant green crop is ploughed in towards the end of winter. Alternate intervals between the vine rows are sown in alternate seasons.

In vineyards that are not irrigated, green manuring is not so satisfactory. Early autumn rains fall in only about one season in five. In their absence the seed does not sprout until the weather is too cold for active growth. It is inadvisable to await spring growth, since it would withdraw from the land, moisture badly wanted by the vine later on.

The foregoing is a necessarily brief outline of a vitally important and rather complex question. In conclusion, I would say—Don't expect good grape crops; don't expect a continuance of good crops,

unless you are prepared to manure. It pays to return to the land rather more plant food than is removed by the crop. Phosphoric acid must, indeed, be applied on an even more generous scale, seeing that it is deficient in most of our soils. Potash, or gypsum to release it, are nearly always beneficial. Nitrogen should be applied judiciously, whenever growth shows room for improvement. Lastly—don't forget lime in soils deficient in this element, and green manuring wherever practicable.

WIREWORMS IN ONIONS.

By G. T. Levick, B.Ag.Sc., Assistant to Entomologist.

Damage.

Last season wireworms caused serious injury to onion crops in practically every district in the State. Damage was recorded from various parts of Gippsland, from the Romsey district, from Brighton, and from the Western District.

The period of infestation appears to be short, extending only from April until August, after which month the late sown crops are safe from attacks.

Nature of Injury.

The young onion plant is liable to attack as soon as the seed has germinated, and remains susceptible as long as the pest is active. The wireworms live beneath the surface of the soil, coming above the ground only under very moist conditions. They eat off the young plants just above the roots, and thus the upper portions soon wither and die. The insects follow up the rows of onions, and where the soil is badly infested, frequently destroy the whole sowing. When this occurs, re-seeding is, of course, necessary, but unless some treatment is used, the resown crop is likely to suffer the same fate as the first.

Description and Life History.

Wireworms are slender grubs, varying in length according to species and stage of maturity, but when doing most damage to onions they are generally about half an inch in length. They are covered with a hard shining integument, which makes them quite tough to the touch, and it is this which gives them their common name. They are very active when removed from the soil, moving rapidly on three pairs of legs.

The adult worms are small hard beetles, popularly known as elaters, click-beetles or skip jacks, but little is known of the details of the life-history. The elaters lay eggs at the roots of the plants or in the soil, and these hatch to young wireworms. The wireworms are said to live in the soil for three years, but as indicated previously, their periods of active feeding seem very limited, no damage being done to onions after about August. This cessation of activity is frequently most marked, an onion crop planted previous to this time being completely ruined, while one planted a fortnight later may entirely escape.

Control.

Experiments in the destruction of the pest were last year carried out by the Science Branch of the Department of Agriculture on the property of Mr. Everett, at Buckley, and thanks are due to him for his

courtesy and for assistance during the progress of the trials. The following materials were tried:—

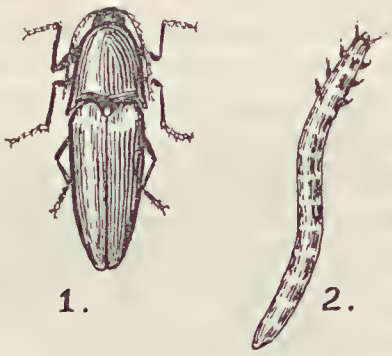
(*a*) Poison bait—Paris green and bran.
(*b*) Clift's insecticide—2 cwt. per acre.
(*c*) Calcium cyanide—½ cwt. per acre.
(*d*) Paradichlorobenzine—½ cwt. per acre.

These were broadcast, and harrowed into the soil immediately before the seed was sown. The object of the first was to poison the worms, while in the case of the three latter, the fumes given off were designed to kill and/or repel them.

In the experiments, the results of which are not regarded as finally conclusive, the only material which appeared effective was the poison bait. It consisted of—

Bran—100 lb.
Molasses—4 lb.
Paris Green—3 lb.

with sufficent water to make a dry mash.



1. Click Beetle. 2. Wireworm.
(Both enlarged about twice, from nature.)

The plot on which the experiment with this bait was carried out gave nearly a full stand of onions, while the untreated control alongside, on last being inspected, was practically bare.

The experiments were commenced late in the year, and as it was impossible to be at hand during the gathering of the crop, a quantitative statement of the effect of the insecticide cannot be given, but the experiments will be continued this year, and it is hoped that a quantitative record will be obtained.

The cost of treatment, about 25s. per acre for materials, is not heavy compared with the value of the crop.

Paradichlorobenzene (soil fumigant) also gave indications that it may be useful when the right time and method of application are discovered.

Wireworms live on almost all known crops; therefore, rotation is of no value, and fallowing does not seem effective in starving them out, as the worms will live on the organic matter of the soil for a considerable period.

Early plowing, with frequent stirring of the soil is certainly beneficial, the worms being in this way exposed to the sun and the birds, and injured at critical stages of their life history.

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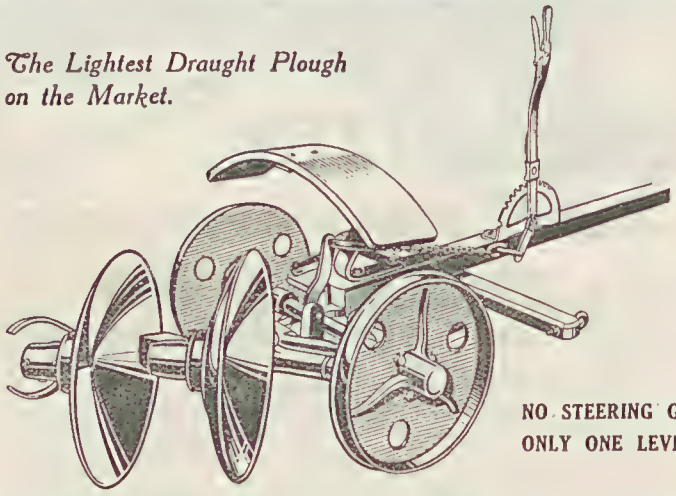

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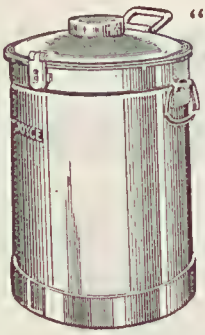

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(For Record of Yields of dams see Red Poll Herd Book.)

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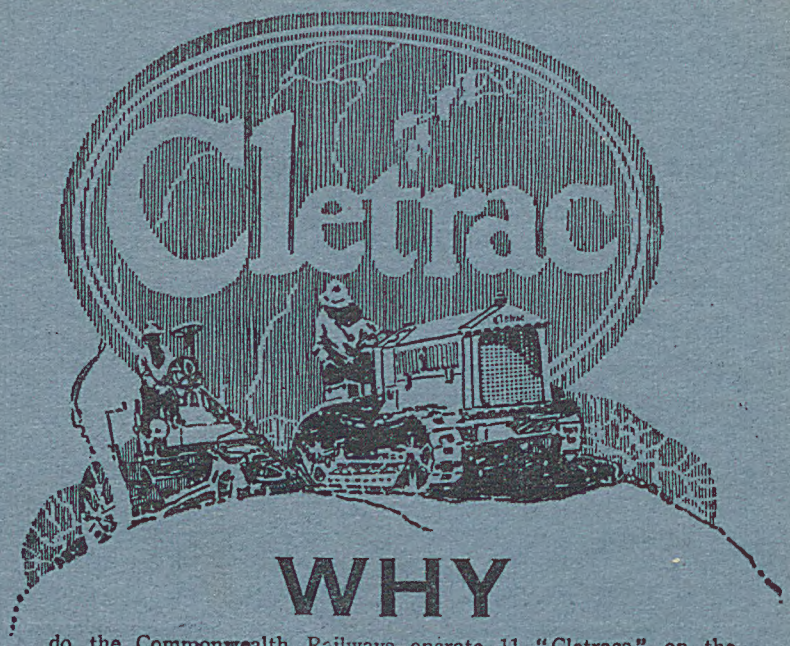

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